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CONTENTS.

EDITORIALS:
- Getting the Most Out of the Power Survey..... 505
- An Opportunity for the Contractor..... 506
- Technical Training 506
- The Cost of Lighting..... 506
- The Gas-Filled Tungsten Lamp for Street Lighting..... 507
- Electric Tube Lighting..... 507

DEPARTMENTS:
- Legal Notes 514
- Commercial Practice 515
- Electric Vehicle Data..... 517
- Electrical Construction 518
- Dollar Wiring Kinks..... 522
- Public Service Commissions..... 523
- Among the Supply Men..... 524
- Questions and Answers..... 525
- New Electrical and Mechanical Appliances..... 539
- Latest Approved Fittings..... 544
- Current Electrical News..... 546
- Record of Electrical Patents..... 551

LEADING ARTICLES:
- Gas-Filled Tungsten Lamps in Chicago Street Lighting.. 511
- Wiring for Coal-Handling Monorail Cranes.—By George Gorman..... 518
- Electrical Engineering Problems.—By R. G. Hudson and W. V. Lyon..... 527
- New England Section of the National Electric Light Association..... 530
- Colorado Electric Light, Power and Railway Association 536

MISCELLANEOUS:
- Convention Program of Iron and Steel Electrical Engineers..... 508
- L. D. Gibbs..... 509
- Ohio New-Business Conference..... 509
- Carbons and Magnetos for the English Market..... 510
- Luminous-Arc Street Lighting at Boise..... 513
- Illumination of Coon Rapids Dam..... 513
- A Synchronizing Reactance for Paralleling Alternators.—By Gordon Fox..... 513
- Book of Electrical Appliances..... 515
- Use of Stickers in England..... 515
- Improving Economy of Louisville Generating Plant..... 515
- Kansas City Campaign..... 516
- Open Offices and Approachable Officials as Central-Station Publicity Policy..... 516
- Specifications for Residence Wiring..... 519
- Among the Contractors..... 521
- Consolidation of Utah Utilities Progressing..... 538

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GETTING THE MOST OUT OF THE POWER SURVEY.

The up-to-date factory owner stands a fair chance of learning something much to his advantage, if he makes the most of his opportunities when the engineers of the electric service company knock at his door and ask permission to make a power survey of the premises in the interest of finding out whether it will pay to install the electric drive. It is natural for the factory executive to view the advances of the central-station man with skepticism, for it is clearly enough the object of the latter to introduce his service wherever possible. Now this attitude is all right in itself, but it should not be permitted to befog the issue and may very properly be kept entirely out of sight until the time comes to discuss test results and estimates of operating cost and fixed charges determined thereby.

Every progressive business man seeks the truth, and the sooner he finds out that his plant can be operated more efficiently for a given outlay the better, if a change in methods appears desirable; and even if a continuance of present operating arrangements is plainly the best course, it is a good thing to be reassured to that effect. The real problem belongs to the central-station man, who must demonstrate if he can the superior economy of his service; and the factory man who throws open the door, gives the electric service company every reasonable facility for testing the power consumption of the various departments and machines, and then grants time for a keen and critical study of the figures assembled and the proposition resulting, is not likely to regret his course. The co-operation required may be simple or complex, according to local conditions, but it is generally worth a good deal more than it costs to have one's plant gone over by the experts in power diagnosis which the modern central station is rapidly developing, to the great credit of the industry.

The man who shuts himself away from such surveys, wrapped in the opinion that his plant is economically impregnable, runs no small risk of paying the price of his self-assurance, and loses what is generally an excellent chance to obtain an inside view of his establishment from the outside standpoint, which in certainly 90 per cent of the cases of which we have knowledge, has at least indicated certain lines of improvement which may be adopted to advantage, quite apart from the question of main power supply.

AN OPPORTUNITY FOR THE CONTRACTOR.

While the condition of financial affairs and international relations has resulted in dull business in many lines, there is at least one class in the country which should find itself in greater prosperity this year than is customary. Not only have we had excellent yields of most of the grain crops, with good prospects for corn, but the demand for these staples and the ruling prices are far above normal. The purchasing power of the farmer, particularly in the North Central and Northwestern States should be far above that in average years.

On the other hand, building construction is almost at a standstill in many places and is nearly everywhere below normal. The electrical contractor is likely to find his business in wiring new structures on the decline and it behooves him to look for new opportunities of activity. The farmers in the territory surrounding his town should be one object of attack. The farm represents an opportunity for electrification greater than that of the city home. The work involved includes not only the wiring of the premises but the installation, where off of central-station lines, of engine, generator and storage battery. The possibilities in this direction are enormous and the business of installing such farm-lighting outfits is capable of enormous expansion. A little consistent solicitation upon the part of the contractor should be able to produce results in this line, especially if he can secure the co-operation of the manufacturers of storage batteries and other necessary equipment. Many of these manufacturers have already been active along this line, opening potentialities which the contractor should be quick to avail himself of. With opportunities of this kind at his door, there is no reason for the contractor sitting down, folding his hands and bemoaning the lack of business.

TECHNICAL TRAINING.

Many discussions have taken place and much difference of opinion prevails as to the best methods of training our young men along technical and engineering lines. A recent report which has been drawn up in Germany on this subject will be of interest to those who are concerned with this subject. Some years ago a number of engineering institutions in Germany united in appointing a representative committee to inquire into the relations between technical institutions of learning in Germany and the industrial demands. This committee has recently made its report, which includes suggestions for improvement.

With respect to the technical universities we find a demand for laying stress upon the fundamentals and for a liberal course of study which, in addition to mathematics and natural sciences, should include sociology, economics, industrial hygiene and general culture subjects. The importance of original research is emphasized. The function of these schools is not regarded as the training of specialists, and early specialization is condemned. Students should be trained for independent responsible work. Reason rather than memory should be developed and the formation of character should be regarded of primal importance. Seminar courses, which permit discussions between teachers and students, are favored as developing individuality.

It is further emphasized that the teaching staff should be men experienced in practical work, and it is regarded as essential that they should keep in touch with present practice. To this end they should be encouraged to engage in consulting and expert work wherever possible.

These recommendations may well be considered by those in charge of American technical colleges. There is too great a tendency to neglect some of the considerations brought out in this report and there is a well marked tendency in some institutions to confine the teaching staff too closely to pedagogical work instead of encouraging them to take an active part in outside work and remain in touch with the latest developments in the practice of engineering.

THE COST OF LIGHTING.

The steady development and improvement of electric lamps has been accompanied by decreases in the specific consumption of energy for producing light. This is true of both the incandescent and arc types. The result is that the operating cost for electric lighting is but a fraction now of what it was a quarter century ago, and this regardless of the cheapening of the electric energy itself. Whereas the early incandescent lamps required a consumption of at least five watts per horizontal candlepower, the latest types of gas-filled tungsten lamps require but one-tenth of this.

The cost of incandescent lighting is made up of the original outlay for equipment, the supply of energy, lamp renewals, and in some cases of a maintenance charge due to the necessity of cleaning lamps or reflectors. In the case of arc lamps we have in addition to the original cost and the energy supply, a charge for carbons and trimming, which may be taken to include repairs and maintenance. The advent of long-burning lamps has made the expense for trimming less important, and increases in efficiency and decreases in energy cost have made the element of first cost much more important than formerly. When running expenses were high the first cost was of little importance. With running expenses low the first cost becomes an important item of expense.

While further advances in lamp efficiency are quite possible and indeed probable, they lose weight in comparison to first cost unless the latter can also be reduced. The first cost of lamps and lamp equipment is consequently becoming yearly of more im-

portance, while further decreases in specific consumption become of less importance. The smaller the latter quantity becomes the less important is a given percentage decrease in its value. Cutting the specific consumption in half, as was done by the introduction of gas in the bulb of the incandescent lamp, was an important step. Cutting it in half again would be of much less importance, since the saving thereby affected would be only one-half as great. Every tenth of a watt that can be saved in the production of a lumen of useful radiation is, of course, worth while, and the idea here is not to belittle its importance, but rather to point out the increasing comparative importance of first cost.

THE GAS-FILLED TUNGSTEN LAMP FOR STREET LIGHTING.

When the development of a gas-filled type of tungsten lamp was announced a year ago, it was stated that this lamp would probably find its most extensive application in street lighting and that in all likelihood it would accelerate the complete retirement of obsolete types of arc lamps. It was not anticipated then by some that the new lamp would become a formidable rival of the more modern and efficient arc lamps, such as the metallic and carbon-flame arcs, nor that it could be made in small enough sizes to displace the standard tungsten incandescent street lamps. Recent developments in the gas-filled lamps, however, have given us a wider range of sizes and units of such reliability and relatively low cost that they seem now to be the most economical illuminant for nearly all classes of street lighting.

What promises to be the most extensive installation of gas-filled tungsten lamps for street illumination is now being made in Chicago. As described on other pages of this issue, this installation, although devoid of spectacular features, has many points of intense interest to lighting men. A small number of gas-filled lamps were placed in series on a circuit with flame arcs and their general performances closely observed for several months. The results obtained warranted a larger installation, which is now being extended to a total of 2,000 lamps. The operation of these lamps has given such promising results that the city has mapped out a program for further extensions to bring the total number of the larger lamps to over 15,000. Besides this, nearly 3,000 small lamps are to be placed on residence streets.

The most striking feature of the Chicago installation with the new 300-watt lamps is that they will be used as a standard unit in place of the 450-watt flame arcs that were adopted a little over two years ago and of which some 10,000 have been put in service. Flame arcs were at that time looked upon as being the "last word" in street illumination, and laboratory tests seemed to verify this conclusion. However, in actual service it was found that the laboratory efficiency of these lamps could not be maintained. The difficulty arose from the practical impossibility of keeping the oxide fumes given off in the flame lamp from depositing on the inner globe and thus gradually increasing its light absorption. Moreover, it was found that this deposit gradually etched the inner surface of this globe and rendered its cleaning more and more difficult, thus further increasing the absorption and lowering the efficiency. On the other hand, the decrease in efficiency of the gas-filled tungsten lamp has been found to be relatively very small. Consequently the net cost of equivalent illumination with the new lamps will be equal to, or less than the figure for the flame arcs. Of course, improvements in electrodes and in the confining of the deposit to the condensing chamber may give the flame lamp a renewed ascendency. It must be borne in mind also that the comparison has been made with white-flame electrodes, whose efficiency is known to be less than that of the yellow-flame type.

Through the development of a 75-watt gas-filled lamp it has also been found possible to extend in a more economical manner the so-called boulevard tungsten lighting system that has been used in residence streets with dense foliage and at the same time to provide more light. Thus both the new units are making possible the more liberal use of electric lighting in Chicago streets.

ELECTRIC TUBE LIGHTING.

The Moore tube, which utilizes the electric discharge through a rarified gas, has been used to a slight extent in electric lighting, but the installations with which we have been familiar have been indoors and few in number. A leading article last week described an installation of this type upon the exterior of an amusement resort in London and indicated an application of this lamp which might well be utilized to a greater extent in this country, namely, for its advertising value.

While at one time the Moore lamp may have been a competitor of the incandescinet lamp in regard to operating efficiency, it has been distanced finally by the tungsten lamp in this respect. Economy of operation, however, is not the only consideration in the art of illumination, and certainly in advertising applications it is a point of minor importance. The Moore tube, like its progenitor, the Geissler tube, is an object of delight to the eye. It fascinates the observer and holds the attention somewhat after the fashion that ordinary illuminants hold the attention of the proverbial moth. The utilization of this type of lamp for advertising purposes might find a large field if it were appropriately exploited.

The electric sign has become a common and recognized medium for drawing public attention both to buildings and to objects of an advertising solicitude. The inherent attractiveness of the bright electric lamp combined with its possibilities of flashing and its adaptation to color effects has made it a foremost medium for this purpose. The Moore tube possesses all the advantages of other electric lamps in this regard besides possessing potentialities which are all its own.

Convention Program of Iron and Steel Electrical Engineers.

The eighth annual convention of the Association of Iron and Steel Electrical Engineers will be held at Hotel Statler, Cleveland, O., from September 14 to 19. The first session, that on Monday morning, will be devoted to the business affairs of the Association and will be for members and associates only. At the afternoon meeting of the first day two papers will be presented as follows: "Underground Transmission in a Steel Plant," by F. D. Egan; "Underground Cables and Accessories," by J. C. Bowman.

On Tuesday morning three papers will be presented as follows: "Application of Auxiliary Apparatus in Iron and Steel Mills," by Stewart C. Coey; "Magnetic Control Characteristics," by H. F. Stratton; "Alternating-Current and Direct-Current Magnetic Control for Auxiliary Motors," by W. O. Lum. The afternoon of Tuesday has been set aside for making inspection visits to the ore dock of the Pennsylvania Railroad Company, the Lakeside power house of the Cleveland Electric Illuminating Company, and the Nela Park laboratories of the National Lamp Works.

On Wednesday morning two papers will be presented: "Some Electrical Problems Practically Considered," by B. G. Lamme; and "The Control of Induction Motors for Rolling-Mill Drive," by Wilfred Sykes and G. E. Stoltz. At the afternoon meeting the two papers scheduled are: "Power Transformer Construction for Steel Mills," by G. A. Waters; and "The Apprenticeship System as Applied to Steel Mills," by B. W. Gilson. At the latter part of this session there will be a discussion of the proposed co-operation between the American Institute of Electrical Engineers and the Association of Iron and Steel Electrical Engineers with the view of working out a method of merging the latter organization with the former. On Wednesday evening will be held the annual banquet, to which ladies are invited.

The papers to be presented on Thursday morning are: "A Synchronous-Condenser Installation for Power-Factor Correction and Voltage Regulation," by W. O. Oschmann; "Watt-hour and Ampere-hour meters and Their Application in Steel Mills," by R. C. Lanphier; "Switchboard and Switching for Steel Mills," by Saul Lavine; "Organized Safety," by L. R. Palmer. At the afternoon meeting there will be a report submitted by R. Tschentscher giving statistical data of electrical application in the iron and steel industry in the United States; the entire afternoon is set apart for this, as it is expected there will be much discussion of this subject.

On Friday morning the two papers scheduled are: "Condensers and Their Auxiliaries," by R. N. Ehrhart; "Silent-Chain Power Transmission," by F. L. Morse. At the concluding session on Friday afternoon a paper will be presented by Allen T. Baldwin, entitled "The Flaming-Arc Lamp in the Iron and Steel Industry." The remainder of the session will be given to the Question Box and also discussions on general subjects.

No fixed program has as yet been prepared for the concluding day, Saturday, which it is expected will be devoted to excursions to industrial plants in and near Cleveland. One feature of the convention will be the display of various safety devices used in the iron and steel industry. Alfred H. Swartz, 10704 Churchill Avenue, Cleveland, O., is chairman of the Convention Committee.

Program for Indiana Electric Light Convention.

The sixth annual convention of the Indiana Electric Light Association will be held at the Hotel Severin, Indianapolis, Ind., on September 23 and 24. The program is planned to occupy four busy sessions devoted to problems arising in central-station practice. The meeting will open at nine o'clock Wednesday morning with the address of the president, Thomas F. English. After some routine business the meeting will be turned over to Fred L. Dennis, of South Bend, chairman of the Association's Accounting Committee, and the rest of the morning will be taken up in an accounting session to discuss the many problems arising in connection with putting into effect the new system of classified accounts.

In the afternoon a paper will be presented by Halford Erickson, of the Wisconsin Railroad Commission, on the subject, "Valuation for Rate-Making Purposes." An address is also expected by Thomas C. Duncan, chairman of the Indiana Public Service Commission. H. W. Young, of Chicago, will present a paper entitled "Commercial High-Tension Outdoor Substation."

On Thursday morning there will be presented three papers as follows: "Profitable Methods of Obtaining Old-House-Lighting Business," by A. T. Holbrook; "Street-Lighting Fixtures and Regulating Equipment for Type C Mazda Lamps," by W. P. Hurley; "Lightning Protection," by V. E. Goodwin.

On the afternoon of September 24 the last business session will open with an address on "Public Policy of Utilities," by D. L. Gaskill, secretary of the Ohio Electric Light Association. A paper entitled "The Newer Mazda Lamps and Some of Their Applications," will be presented by J. R. Colville. Reports of committees will be presented and the election of officers will close the formal business. The convention will close with a banquet on Thursday evening, followed by dancing.

Thomas Donohue, manager of the Indiana Lighting Company, Lafayette, Ind., is secretary of the Association.

Vermont Electrical Association.

The Vermont Electrical Association will hold its thirteenth annual convention at Brattleboro, Vt., September 17-18. The program consists of an informal reception and banquet the first evening, followed by addresses by the presidents of the Association and of the Brattleboro Board of Trade, a motion-picture exhibition of electric vehicles, and music and dancing, at Island Park Pavilion.

The following day, in the morning, a business meeting will be held, with election of officers and a paper by C. W. Bettcher, of Harrison, N. J., on "The Type C Mazda Lamp." At 11 o'clock the party will leave on an automobile trip to the 24,000-horsepower generating station of the Connecticut River Power Company at Vernon, going thence to Spofford Lake, where a "clam bake extraordinary" will take place.

In the evening there will be an illustrated lecture by D. B. Rushmore, of Schenectady, N. Y., on "Electricity in the Construction and Operation of the Panama Canal."

Boiler Specifications.

The American Society of Mechanical Engineers has a Boiler Specifications Committee which has been formulating standard requirements for boilers. It is hoped that boiler-inspection laws in the different states and cities may thereby be made uniform. The preliminary work of the committee was embodied in a report which was issued last February. This was discussed at the spring meeting of the Society and at a conference held in Chicago, June 15.

The committee will hold a public hearing on September 15 in the rooms of the Society, 29 West Thirty-ninth Street, New York City, at 10 a. m. Formal invitations to attend have been sent to other organizations known to be interested, and others wishing to participate are also invited.

Boulevard Lighting at Nashville.

New lighting standards on Capitol Boulevard at Nashville, Tenn., have been put into use in the last few days and at night lead the way to the State Capitol, which itself is outlined in electric lights.

L. D. Gibbs.

Louis D. Gibbs, who has been elected president of the New England Section of the National Electric Light Association, is a conspicuous example of the rapid rise in influence and usefulness which the electrical industry promotes, when coupled with ability and enthusiasm. Mr. Gibbs has only passed the two-score milestone, but he has come to be a landmark on the electrical horizon. His physical and mental powers are in close correspondence, both being organized on a large scale.

"Louie" Gibbs, as he is affectionately called by the fraternity, had some help in being born, but otherwise is a self-made man. The former episode occurred at St. John's, Mich., while the latter has been achieved at the local high school, at Oberlin College, and in the University of the World.

Young Gibbs started out, as so many successful publicists do, by learning to stick type and kick a job press. He taught himself shorthand on the side, as if 10 hours in a printshop was not diversion enough. Desire to see the farther west took him to Denver in 1889, but he returned to the home town and bought the local newspaper called the *St. John's News*. This he built up from a dubious success into a live publicity organ with three times the circulation it had when he took hold of it. We are not prepared to say whether the subscription list was reckoned in thousands or hundreds, but the point is, L. D. Gibbs, "Ed. & Prop.," made a thorough going success of the *News*, as he has a way of doing with everything he undertakes.

But holding down the editorial chair of a country weekly was not enough of an achievement. The ambition to gain a college education caused him to dispose of the newspaper property and enter Oberlin. Here Gibbs did reportorial work for Chicago, New York and Cleveland newspapers, and in the last two years of the course conducted a stenographic bureau which did typewriting for the professors.

In April of 1898, the last end of the Senior year, an opportunity offered to join the staff of the *Springfield* (Mass.) *Republican*, that famous nursery of young journalists. Permission was granted by the Oberlin faculty to finish the course and take his final examinations *in absentia*, which he did, receiving his diploma in June by parcel post.

The Spanish War came on, with its widespread impetus to newspaper activities, and Gibbs graduated to the position of head city reporter of the *Republican*. Then he went to Washington as private secretary to Congressman Gillett of Massachusetts. He was appointed secretary of the House Committee on the Civil Service, working at the same time as Washington correspondent of the *Republican*.

In 1904, Mr. Gibbs became connected with the National Republican organization, having charge of furnishing publicity to newspapers throughout the country. He returned to the Capital City and there did free-lance work for newspapers and magazines, becoming associate Washington correspondent of Boston's erudite journal, the *Transcript*.

L. D. Gibbs,
President, New England Section, National Electric Light Association.

The magnetism of electrical activities thereupon got a hold upon the subject of our sketch, to the end that he went to Boston in 1906 and joined the sales department of the Boston Edison Company. Four years later Mr. Gibbs was made superintendent of advertising of that company, and the next year the advertising department was organized with Gibbs at its head.

Originality, wit, energy, persistence, courtesy—these are traits which characterize the new president of the New England Section, and make folks look up to him, as they have to do in a stand-up conversation.

He was interested in the formation of the New England Section and was present at the first meeting, at Portsmouth, N. H., being made assistant secretary then and there. In 1911 he was chosen secretary and treasurer, in 1912 a member of the executive committee, and last year vice-president. This June he was elected third vice-president of the National Electric Light Association at the Philadelphia convention.

Mr. Gibbs was a member of the committee on organizing the Commercial Section, and of the Membership Committee. Last year he was vice-chairman of the Committee on Merchandising and Advertising of the Commercial Section, N. E. L. A. His other affiliations read like the Almanach de Gotha. He has been secretary of the New England Section, Illuminating Engineering Society, and of the Electric Vehicle Club of Boston. He is an associate member of the American Institute of Electrical Engineers, a member of the National Civic Federation, the Pilgrim Publicity Club, the Boston Athletic Association, the Engineers' Club and the Hunnewell Club of Newton, the pleasant suburban city where, with Mrs. Gibbs, he has his home.

Ohio New-Business Conference.

The Committee on New-Business Co-operations of the Ohio Electric Light Association has planned to hold five conferences during the coming year. The first will be held on September 17 at Toledo. Other meetings will be held in November at Cincinnati, in January at Cleveland, in March at Dayton and in May at Columbus. Topics connected with the increase of station load will be considered, with especial attention to the securing of power business.

The committee, of which Thomas F. Kelly, of Dayton, is chairman, invites suggestions as to making these conferences of the greatest value.

The sessions at Toledo will be held at the Elks' Club.

The Executive Committee of the Association met on August 12 and adopted the suggestions of Chairman Kelly for the work of the year by a unanimous vote.

Carbons and Magnetos for the English Market.

Among other electrical lines where there is a shortage on the English market now that practically all imports from Continental countries have ceased to go in, are carbons for electric lamps and ignition magnetos for automobiles. For many years reliance has been placed on big supplies of carbons at very low prices from Germany, Austria, France and Belgium. The result has been that British carbon-making factories have only been conducted at a loss, and today actual manufacturing operations are mainly conducted at one factory at Witton. The requirements of the Admiralty, War Office and other Government departments, of searchlight and other carbons essential to the maintenance of defense and offense, are very large and the greater part of the output at Witton will be thus absorbed. It therefore follows that for such other needs from end to end of the Kingdom the small surplus capacity of this works will practically be all that is available save for such foreign stocks as are already in hand and such quantities as may enter from the United States and from European countries not at war. Spain has certain carbon-making works sending small supplies to England but it is thought that as America too has been a large importer from Germany, she will be unable to send much across the Atlantic, needing all her output for herself. American works will know whether this is a reasonable assumption on the part of British people. Lighting and other authorities who have been dependent upon German and Austrian works for supplies in the past and have run short are now caught napping, and it is feared that serious difficulties will arise. In at least one city in Ireland the public lighting hours have been curtailed, the arc lamps being shut off before midnight, owing to lack of carbons, the authorities being anxious to make what little they have last as long as possible. Other authorities who have clung to the arc lamp for street and open-space illumination are expected to find it necessary to change over to metal-filament or other lighting.

The foregoing are suggested merely as illustrations of the difficulties which are expected to arise. No doubt manufacturing operations will be expedited to the utmost and some new works may, if the war lasts, find their way into operation in time to take advantage of the higher prices obtainable in the absence of Continental competition.

In regard to magnetos for automobile works, it is understood that these have been imported into England in great numbers from Germany and the shortage may possibly become serious. The motor car is playing so large a part in this war, both in England, where cars have been commandeered by the thousand, and by the British on the Continent, that the requirements for such purposes alone are not light. It is expected that the several factories in England that have been, during the last year or so, handling the matter enterprisingly will be producing at their maximum capacity continuously. But according to present indications both carbons and magnetos should be articles in which American assistance would hardly be resented if the actual requirements are properly understood. In the Colonial markets the position will be similar, as they too have depended upon the same sources of supply to a large extent.

Long Transmission Line in Operation.

The longest power-transmission line in the world, reaching from the generating plant near Bishop to El Centro, Cal., was put in operation last month. The distance is over 400 miles. The capacity of the line is over 13,000 kilowatts.

There are four substations on the new line, at Banning, Coachella, Calipatria and El Centro and each of these will be the nucleus of a distributing system. There are four power plants in Imperial Valley, but these were unable to supply the demand and arrangements were made for a supply of power from the Southern Sierras Power Company. The greater part of the power transmitted over the new line will be used for irrigation pumping.

Southern Sierras Power Company is controlled by Nevada-California Power Company and owns two hydro-electric plants, with a steam generating plant at San Bernardino, Cal.

Society for Electrical Development Co-Operating with Manufacturers in Securing South American Trade.

The Society for Electrical Development, Incorporated, has announced that it will co-operate with manufacturers of electrical material to secure information relating to the South American market. If manufacturers desire literature translated into Spanish for circularizing South American countries the Society will have this done and charge for the actual cost of such service. The Society is also compiling information with regard to producing electrical supplies heretofore imported from Europe. Manufacturers are requested to send information to the Society with regard to what they have heretofore been importing. In each instance the Society will endeavor to secure an American manufacturer who is able to produce what has heretofore been procured from abroad.

Electrical Exhibit at Tennessee State Fair.

Practically all of the Nashville electrical contractors and representatives of electrical appliance manufacturers, etc., are co-operating in preparations for the electrical exhibit which will be given in the Agricultural Building of the Tennessee State Fair, to be held at Nashville, Tenn. Every conceivable use to which electricity may be put legitimately will be illustrated in the exhibit, which will pay particular attention to the household appliances now on the market. One of the displays will be an electrically operated milking machine which will be shown in operation on cows brought in from the livestock sections of the fair.

James A. Cayce, of the B. H. Stief Jewelry Company, is chairman of the committee representing the Jovian League which is engineering the electrical exhibit. Other members of the committee are Robert C. Leonard, statesman of the Jovian Order; J. P. W. Brown, superintendent of the Nashville Railway & Light Company; J. E. Carnes, salesmanager of the Nashville Railway & Light Company.; J. W. Pentecost, superintendent of the municipal lighting plant; James Shingleton, of the Nashville Machine Company; J. P. Lawrence, of Herbrick & Lawrence.

Nearly all of the important manufacturers in the electrical field will be represented, either through their local branches or by displays from the main offices.

Night School for Electric Garage Men at Armour.

At the first fall meeting of the Chicago Section of the Electric Vehicle Association of America, held at the La Salle Hotel, Tuesday evening, September 8, Prof. E. H. Freeman anounced that a course of instruction for electric garage men would begin the first week in October at Armour Institute of Technology. There will be two two-hour periods each week for 10 weeks. The fee will be $10 for the entire course. The students will be thoroughly instructed in the principles underlying their practical work in charging storage batteries, repairing and maintaining the electrical equipment of the vehicles and garages.

The two-reel motion picture, entitled "Selling Electric Vehicles," written by W. C. Andrews, and the scenario of which was arranged by S. G. Thompson, entertained the meeting, and was pronounced a decided hit by all present.

Gas-Filled Tungsten Lamps in Chicago Street Lighting.

Over 15,000 of the New Lamps to Rival Flame Arcs.

In line with its policy of keeping fully abreast of developments in lighting equipment, the municipal street-lighting system of Chicago has in the last few weeks put into service nine circuits of gas-filled tungsten lamps. On August 18 a circuit containing 240 four-ampere, 75-watt, series lamps of this type was put into operation in the North Side residence district commonly known as Ravenswood. On August 27 a circuit with 132 20-ampere, 300-watt, series gas-filled lamps was turned on in the South Side district lying between Sixtieth and Sixty-third Streets and between Indiana and Cottage Grove Avenues. The latter is the more noteworthy installation, because all indications seem to show that the performance of these new 300-watt lamps will fully equal, if not exceed, in all respects (including actual cost of equivalent illumination) the results obtained with the flaming arc lamps that form the standard Chicago street-lighting unit.

View in Sixty-Second Street, Chicago, Looking East from South Park Avenue.

Within the past two weeks seven additional circuits have been put into service, thus bringing the total number of 300-watt gas-filled lamps in use on September 8 up to 728. More are to be added from time to time, so that before many months over 15,000 of these lamps will be in use in Chicago.

Since early in the present year the city has been trying out gas-filled tungsten lamps. Many laboratory tests were made, followed by a preliminary or trial installation of a number of the new 600 and 1,000-candlepower lamps in series with flame arcs on a 10-ampere circuit on West Congress Street. Some of these lamps are still in that circuit after several months' service. These lamps gave such a good account of themselves even under adverse conditions, such as violent voltage surges, that it was deemed prudent to install quite a batch of the lamps and watch their performance in regular service. As narrated in previous issues, 2,000 Westinghouse Mazda lamps, rated at 300 watts, 600 candlepower, 20 amperes, were ordered a few month ago. The cost per lamp is reported to have been about $4, this price being obtained on the understanding that, if the lamps gave good performance results, additional lamps would be ordered to make the total number 10,000. The manufacturer guaranteed a life of 1,000 hours and offered to replace without charge all lamps burning out in service less than this number of hours.

To accommodate the new lamps special fixtures were designed. These were described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of July 18, 1914, but in that description credit for originating the design was unintentionally not given to the electrical engineers of the city. After careful study of the requirements, the design was developed by the Chicago Department of Gas and Electricity and subsequently altered in details by the Electrical Department of the Sanitary District of Chicago which installs the equipment, furnishes the lighting current and operates the substations.

The fixtures closely resemble the flame-arc equipment in appearance. In place of the arc mechanism there is a compensator furnishing 20 amperes to the lamp from the 10-ampere line circuit; the compensators have an extra tap to permit their use on 6.6-ampere circuits, the lamp current in this case to be 20 amperes also. The outer globe is an Alba glass diffusing globe. Within this some of the lamps are being equipped with a special refracting globe made of two cup-shaped prismatic glass globes sealed together with the prisms on the inner surfaces to protect them from dust, the outer surfaces being smooth; this refractor is intended to give a greater lateral distribution of light. Special care was taken to provide the fixture with ample ventilation through screened openings to keep out insects.

The lamps placed in service August 27 are mounted on tubular steel poles placed on one side of the street only and at a height so as to have the center of the lamp about 22 feet above street surface. For cleaning and renewal the lamps are lowered to the ground, the lowering rope passing up through the pole after the lamp attendant has lengthened it by an extension rope he carries. Service is from overhead wires. This type of construction is intended for outlying districts and was described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 6, 1913, in an article dealing comprehensively with the Chicago street-lighting system. In the new installation illustrated in the accompanying views the lamps are spaced from a minimum of 160 to a maximum of 250 feet apart; this variation in spacing is caused by the requirement that a lamp must be placed at each street and alley intersection. In the view shown of Sixty-second Street the lack of alinement of the lamps is due to the street intersections having large-radius curbs, which makes the street-corner lamps slightly out of line with the alley-corner lamps.

The light furnished by the new lamps is very pleasing in color and steadiness. The outer globe is uniformly luminous and gives a nearly white light; the density of these globes and the height of the lamp suspension is sufficient to reduce glare to a minimum. Yet the lamp is easily recognized by the eye as being as powerful a light source as the white carbon-

flame arcs in use in Chicago. The light is very steady compared with flame arcs. The illumination produced on the street is very well distributed and as can be seen in the Sixty-second Street view the entire street and sidewalk surface as well as the building fronts are uniformly illuminated. It is difficult without photometric instruments to distinguish between the light distribution of lamps with and without the special inner refracting globe, this being largely due to the fact that the outer opal diffusing globe greatly affects the results produced by the refractor. It is the intention to install some of the new units with clear-glass outer globes, in order to determine the effect of the refractor under the most favorable conditions.

Although it is too early to compare the performance of the new lamps with that of flame arc lamps, data obtained by the city's engineers tend to show that the two types are on a closely competitive basis, despite their difference in rated efficiency. The flame arcs consume about 460 watts each and give a maximum of 1,150 candlepower in a direction close to 30 degrees below horizontal when tested under laboratory conditions. It is found, however, that in actual service the deposit of condensed fume on the inner globe greatly reduces the light flux that is actually transmitted through the globe. Tests have shown that the transmission efficiency of the new clear inner globe is 92 per cent. After being in service several months the soiled globe transmits only 47 per cent of the light generated. The electrodes have a life of something over 100 hours. At each trim the entire flame and condensation chamber is thoroughly brushed out; this includes the inner globe, when it is found that this raises its transmission efficiency to 54 per cent. When the globe is well washed out its efficiency is brought to 75 per cent. When the fine ingrained deposit is removed by hydrofluoric acid, the efficiency is restored to 92 per cent, or the original. With the attention that it is possible to give the inner globes in ordinary service, it is found that on the average the inner globe transmits about 55 per cent of the light. This average absorption of 45 per cent is so high because the deposit in the inner globe gradually etches its inside surface, making its complete removal during trimming more and more impossible.

The new gas-filled lamps, on the other hand, give an average maximum of 600 candlepower with 300 watts power consumption. Tests show that in the early part of their life this candlepower increases slightly and then gradually diminishes, so that the average candlepower during rated life shows but very little depreciation from the rating. Thus the 300-watt tungsten lamp will give nearly equal illumination to that of the flame lamp. Carrying the calculation further and taking into account electrode and lamp renewals, cost of trimming and cleaning, cost of current, etc., it has been found by the city engineers that the cost of maintenance for the two types of units will be practically equal for equal illumination, if the nitrogen lamps have exactly the 1000 hours of rated life. If they exceed this, the cost will be in favor of the gas-filled lamps; if the life is less than the guaranteed 1,000 hours, the cost will also be in favor of the new lamps, because of the free renewal by the manufacturer under this condition. Other advantages on behalf of the new lamps are that the initial investment per complete fixture and lamp unit is only about one-half that of flame arcs, more lamps can be run circuit, and light is steadier.

In the case of the 75-watt, four-ampere, gas-filled lamps installed in the Ravenswood district, these lamps also are indicating a favorable performance. They give a maximum of 100 candlepower and are being used in an extension of the series-tungsten system in residence districts for lighting streets where trees are very numerous. Thus this extension is being effected with 75-watt instead of the present 80-watt lamps and each new lamp gives 100 instead of the present 80 candlepower, a gain both in power economy and in illumination. The lamps are mounted inverted in totally inclosed diffusing globes on top of remodeled old gas-lamp posts, as described in our issue of September 6, 1913. In the new installations, however, film cutouts are used in place of the shunt reactance coils.

The excellent results that are anticipated from the use of the 300-watt gas-filled lamps have caused the city's engineers to plan for a much more liberal installation thereof than contemplated a few months ago. In all probability the number of flame arcs, which now total about 10,000, will not be increased. Instead of making improvements with that type of lamp, it is planned to use 300-watt gas-filled lamps as follows: 1,166 to replace an equal number of old 10-ampere direct-current open arcs; 6,328 to replace seven-ampere alternating-current inclosed arcs; 3,855 for installation on new overhead circuits already constructed, chiefly on gas-lighted streets, in accordance with the city's original construction contract with the Sanitary District, but not yet equipped with lamps; 3,722 for new extensions made possible by the fact that the new lamp unit takes only 300 watts as against 450 to 460 required by the flame arcs formerly regarded as the standard unit. This program thus calls for a total installation of 15,071 of the new 300-watt tungsten lamps in the near future. It is also planned to extend the ornamental residence-district lighting by adding 2,700 of the four-ampere, 75-watt, 100-candlepower, series gas-filled tungsten lamps. These improvements will bring all of the city electric street lighting to a modern and efficient condition and at the same time extend it into many districts now inadequately lighted.

Gas-Filled-Lamp Illumination of Prairie Avenue North of Sixty-Third Street.

The annual report of the Department of Gas and Electricity of the city of Chicago, Ill., shows that a total of 318,569 horsepower is supplied from central stations in that city for power purposes.

Luminous-Arc Street Lighting at Boise.

An agreement has been entered into between the city of Boise, Idaho, and the Standard Engineering Company whereby the new street-lighting system will be tested, and should everything prove to be in satisfactory condition it will be lighted regularly hereafter. This special street-lighting system, which has met with several vicissitudes, consists of four-ampere inverted-type luminous-arc lamps, mounted on ornamental posts. Practically the entire commercial district of the city has been covered with the system, with posts on each side of the street.

Installation was made under the general public improvements law of Idaho, under which the cost of the system is assessed against the abutting property owners. Under keen competitive bidding the Idaho Railway, Light & Power Company made a contract with the city to light these posts at the rate of $11.24 per lamp per year, including maintenance. This company later passed into the hands of a receiver and the receiver applied to the court for relief from the contract on the ground that to supply this service at the price named would subject the company to a loss which would fall directly upon its creditors. The relief was granted by the court. In the meantime the system which had been completed for several months remained dark.

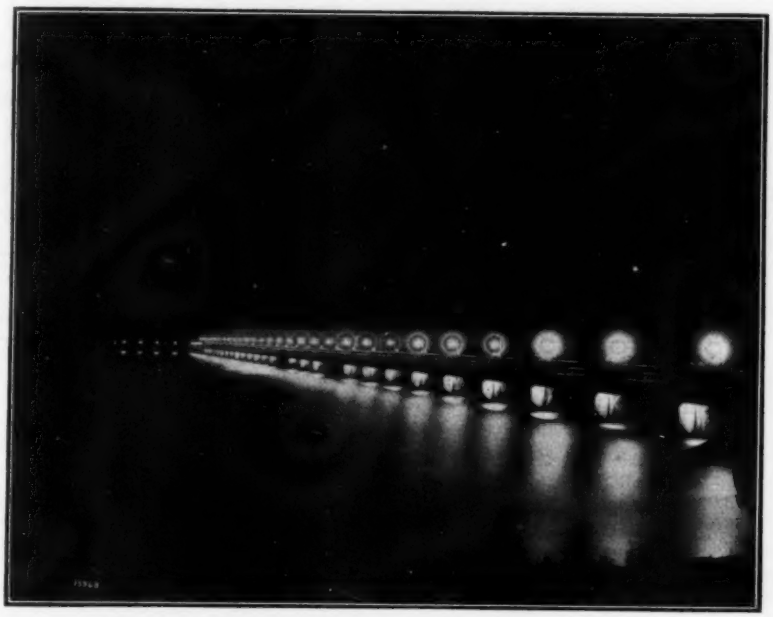
Later a contract was entered into between the city and the Idaho Power & Light Company, a competitor of the former company, under which the city purchases the energy for operating the system at the rate of one cent per kilowatt-hour and attends to the maintenance and operation of the system itself. Numerous delays, however, have prevented the initiation of service.

Illumination of Coon Rapids Dam.

The dam of the Coon Rapids hydro-electric plant on the Mississippi River above Minneapolis is lighted by means of 100-watt Mazda lamps mounted on gooseneck standards for the purpose of providing safe passage of persons on the bridge over the dam and to facilitate the work of handling the gates and dealing with ice and logs which come down the river at certain periods of the year.

The accompanying illustration shows the appearance of the dam at night.

Two of the five units at the Coon Rapids plant are now in operation and delivering power regularly to Minneapolis.



Illumination of Dam at Coon Rapids on the Mississippi River.

Electric Cooking in Montana.

During the last week in August the *Billings Daily Tribune*, of Billings, Mont., had a domestic science expert to lecture and give demonstrations of plain and fancy cooking. At the end of the week there was a baking contest, the winner of which was given the choice of an electric or gas range as first prize.

The judges did not know by which process the entries for this prize had been prepared, but decided in favor of a young woman who had used an electric range in preparing the food and she selected the electric range as her choice for the prize. The food was auctioned off for the benefit of local charities and the prize-winning cake was bid in at $10.00 by J. F. Roche, manager of the Montana Power Company.

Traction Engine Furnishes Emergency Power.

A big traction engine which has been the source of power for the Leitchfield (Ky.) Electric Light & Power Company for some months has been retired at last, while the work has been taken up by the company's new steam plant. The old plant was destroyed by fire last October and though the gasoline engines which had done duty there were repaired and put to work in a temporary structure, they did not give satisfactory service. When the steam plant was decided on, the traction engine was pressed into service and has done good work. The new plant was put in operation on September 1 and is supplemented by a storage battery which will keep the current up at intervals when shutdown of the steam engine may be necessary.

A Synchronizing Reactance for Paralleling Alternators.

Enlarging upon the discussion published in the issue of July 18 in regard to reactance coils for use in synchronizing alternators, it may be said that the practice along this line has not been standardized. But few installations have been made to the writer's knowledge, but these few have proven notably successful and have rendered the paralleling of machines a matter of easy accomplishment.

Since the reactance coil is in the nature of a current-limiting reactance it is probably best made with an air core along the lines of the larger reactances used for subdividing station buses and protecting machines against short-circuit conditions in the large plants. But a comparatively small coil is necessary for ordinary alternators of 100 to 500-kilowatts capacity. If an iron-core reactance is to be built it may be smaller than the air-core coil, but the iron should be worked at a point low in the magnetization curve to prevent saturation at a low current value.

The purpose of the reactance is to limit the short-circuit current in a single phase of the alternators in question when they are thrown together out of step. It is probably best to limit the instantaneous rush of current to about twice full-load value. This being a figure empirically selected, exactness in design is not necessary, a considerable leeway being allowable.

Probably the best method is to determine the synchronous reactance of the machines upon which the coil is to be used. This can be done by short-cir-

cuiting one phase through an ammeter and building up the field until full-load current is reached noting the corresponding excitation. Then, upon open circuit, the voltage corresponding to this excitation is noted. This voltage divided by full-load current will give sufficiently accurately the synchronous impendance of one phase.

Dividing twice the alternator voltage by twice the full-load current will give the impendance necessary to maintain the current within the prescribed limits if the machines are in phase opposition when the switch is closed, the most severe condition. From this value of impendance subtract the sum of the synchronous impendances of the two alternators. The difference will give approximately the required impendance of the reactance coil. Vector diagrams are hardly necessary since accuracy is not essential and the impendances are all largely reactive, hence nearly in phase, so that an algebraic subtraction is sufficient.

Since the reactance coil is used for very intermittent service and carries only an instantaneous load, the copper can be worked quite hard. No. 6 wire can be used for 100 amperes and other sizes in proportion. The coil must be capable of carrying twice full-load current, or, in the case of two machines of different capacities, it will carry perhaps the sum of their load currents. From this data the wire size can be determined.

The desired reactance in henries being known as computed above, the coil can be designed by use of the approximate formula

$$L=4\pi^2r^2N^2/10^9l$$

where

L=reactance in henries;
r=radius of the coil in centimeters;
N=number of turns;
l=length of coil in centimeters;

The coil may be wound on a wood, fiber or porcelain core and should have end flanges or other means to anchor the winding to prevent injury due to the magnetic thrust.

Gordon Fox.

War Affects Power Project.

Shortly before war was declared, the city of Warsaw, capital of Russian Poland, had arranged with a German company to erect an electric power station at Pruszkow, about 22 miles from Warsaw. Current was to have been transmitted to the city to help out the existing Warsaw plant.

Legal Notes

Foreclosure of Idaho Utility Refused.

Charging that the owners of the Idaho Railway, Light & Power Company looted the Idaho-Oregon Light & Power Company while they were directors of the latter concern as well as of the first, Judge Dietrich, in the United States District Court, at Boise, Idaho, has refused the order of foreclosure sought by the State Bank of Chicago against the Idaho-Oregon Company, the Bankers Trust Company and A. W. Priest and others. In announcing his decision, Judge Dietrich says:

"These and other considerations strongly persuade me to the view that in response to the prayer of the intervenors in a plenary suit, a court of equity could have properly interferred to prevent the illegal diversion of its bonds or could now decree their restoration. But it is unnecessary to go so far; we have here no plenary suit in which creditors are seeking affirmative relief for themselves or the restoration of property to the corporation. The railway company is in reality the actor. It is not content with what it was wrongfully able to acquire through its control of the power company. It is dependent upon and is here invoking the assistance of a court of equity to make actually available to it the fruits of its wrong doing."

The suit was brought to foreclose a trust deed to all the property of the power company given to secure 7,000 bonds of $1,000 each. The present controversy involves the status of 825 first-mortgage bonds claimed by the Idaho Railway, Light & Power Company.

In his opinion, Judge Dietrich takes up the history of the various transactions involved in detail. The suit was brought when, a short time before the decree of foreclosure was issued on the first-mortgage bonds, the Priest interests sought to intervene and to prevent the foreclosure, charging that the railway company was trying to wreck the power company and thereby injuring the holders of its first-mortgage bonds.

Bondholders of the Idaho-Oregon Light & Power Company will be on hand to bid in the property of that company when it is placed on sale September 30. So declared W. J. Ferris, receiver for the concern, when asked what would be the effect of the opinion recently handed down by Judge Dietrich on the Boise power controversy. Mr. Ferris believes the position of the Idaho-Oregon bondholders is much strengthened by the court's decision.

"The court's decision removes all question as to the stability of the Idaho-Oregon," said Mr. Ferris. "Another factor that will add to the strength of its position is the completion of the Oxbow power plant. It will be in operation by September 1, some time prior to the sale.

"This means that when the bondholders bid on the property they will be bidding on a concern fully equipped to render the service required of it. At present the company is buying, during the irrigation season, some 3,000 horsepower. With the completion of the Oxbow plant it will have a surplus of 2,000 horsepower, since the Oxbow plant will develop 5,000.

"Thus the company is able to cover its field, and with Judge Dietrich's decision on the disputed bonds, the way is cleared for the Idaho-Oregon bondholders to bid in the property and protect their investment."

Sustains City Ordinance Requiring Underground Construction.

In an opinion handed down last week by Judge Josiah Cohen, in the Common Pleas Court at Pittsburgh, Pa., the Duquesne Light Company was compelled to comply with a city ordinance requiring overhead wires to be placed underground. The company held that this was a violation of its franchise, but as the opinion reads that it is for the benefit of traffic and the welfare of the city, the wires were removed from South Main Street, Pittsburgh.

Rates Declared Unremunerative.

Master in Chancery H. M. Wright of the United States District Court, at San Francisco, Cal., has handed down a decision in favor of the Pacific Gas & Electrict Company in its attack on the legality of the city ordinance fixing the rates for electric current for 1913-1914, on the ground that the yield to the company is only 5.82 per cent.

Commercial Practice
Management, Rates, New Business

Book of Electrical Appliances.

The United Electric Light & Power Company, New York City, has issued a booklet entitled "The Book of Electric Appliances." This has been issued in order that the present and prospective consumers of the company might know of the innumerable electrical appliances that have been devised for the convenience of the housewife and business man.

The company conducts elaborate salesrooms at 138 Hamilton Place, New York City, and has long felt that a comprehensive catalog describing in detail the many modern electrical appliances, with their prices clearly set forth, would be helpful.

The booklet is illustrated and lists a remarkable variety of appliances for the household and the office. The index shows over 150 entries and an interesting page tells what one cent's worth of electricity will do in a number of heat and power applications.

The front cover of the booklet is in colors and represents "Electricity, the Modern Servant" as a woman seated and holding in her hands wires which extend to various appliances.

Use of Stickers in England.

The utilization of poster stickers for display on the back of envelopes used for correspondence, and on blotters and other advertising matter, is in high favor in England at the present time. Electrical concerns are availing themselves of this inexpensive and effective mode of publicity, all phases of the business being depicted on the stickers, which are neatly printed in colors on gummed paper, about 1.75 by 3 inches. The stickers are made in sheets of a dozen or twenty each, with perforations between the individual stamps.

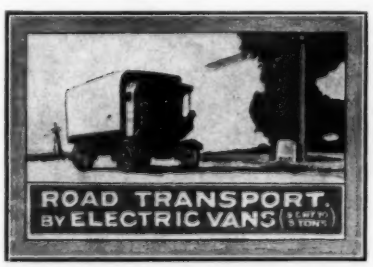
Companies that are interested in electric-vehicle promotion, or in the supply of energy for light, power, cooking, heating or refrigeration, procure the stamps in large quantities and not only use them for their own correspondence, but also distribute them in varying quantities to customers who may be interested in the various phases of the subject and who use the stamps on their letters. Thus a wide distribution of the stamps is effected, with large possibility of returns for a small outlay.

Business houses using electric trucks place stamps advertising the merits of the electric vehicle on their stationery as an advertisement of their own progressiveness in methods of delivering goods. The West Ham Electricity Supply Corporation in London has been very aggressive in electric-vehicle propaganda and has not only provided up-to-date charging facilities, but has also

Poster Sticker Used by St. Marylebone Electric Supply Department.

done a vast amount of publicity work throughout the metropolis. One of the stickers distributed by this corporation is shown herewith.

Likewise, the electricity supply department of the Borough of St. Marylebone has adopted a sticker for its correspondence, which shows the modern uses of electrical energy in cooking.



Poster Sticker Used by West Ham Electricity Corporation.

This particular central station is one of the foremost in developing a cooking load, and its income from this source is reaching large proportions. It operates in the fashionable West End of London, where thousands of flat-dwellers have adopted the electric range as the most economical and convenient means of cooking for a small family. There are also many electric ranges in restaurants, clubs and department stores, among the latter being Selfridge's, known in London as the American store. A reproduction of the poster stamp used by this central station and many of its customers is shown herewith.

Among the consumers of electricity for cooking, supplied by the St. Marylebone station, is the Electric Bakeshop on Oxford Street, where the entire baking, kneading and molding equipment is electrically operated.

Improving Economy of Louisville Generating Plant.

When the Louisville Gas & Electric Company was formed by merger of existing utilities two years ago, it took over two large electric plants, one belonging to the old Louisville Lighting Company and the other that of the Kentucky Electric Company. The latter was more efficient, being newer and better equipped. Located between Second and Third Streets, it is virtually on the river bank. Tunnels reaching out under the river supply an unlimited quantity of condensing water which is conducted into a deep well where are located the condensers, thus avoiding the necessity of raising the water. The old Louisville Lighting Company plant at Fourteenth and Broadway, is two miles from the river and depends upon deep wells for condensing water.

The first thing the Louisville Gas & Electric Company did was to construct an electric tie line between the two plants by which current generated at Waterside could be transmitted to the other plant and distributed through the circuits centered there. By this means the load on the two plants was equally divided. At the same time extensive additions were begun to the Waterside plant and these are rapidly nearing completion and will soon be able to supply all the current used in Louisville.

Efficiency of the Waterside plant extends even to the coal burned. It is received by an elevated track and all the boilers, being equipped with the very best pattern of chain grates, are able to utilize the cheapest grades of coal. The old plant, the ground on which the boiler

house is built being cramped, must use a different type of stoker which cannot use the low-grade coals. The contract for approximately 100,000 tons the company is to make shortly, will be mostly for low-grade western Kentucky coals, whereas heretofore about half of what was bought was of the higher grade and costlier eastern Kentucky coal. When the new enlarged plant is in complete operation it will probably be second to none in the country in respect to its advantageous operation. Great operating economies already have been effected by transferring the load, according to Donald McDonald, vice-president and general manager of the company, but when the new plant is completed still greater economies will result.

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Open flames mean matches, and matches mean *danger!* Electric Light is safe—proof against ignorance or carelessness.
Telephone us today for special house wiring offer
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Fifteenth Street and Grand Avenue
Telephones: Bell Grand 50 Home Main 50
SAFETY FIRST

Advertisement of Kansas City Electric Light Company.

Kansas City Campaign.

The accompanying illustration shows one of a series of advertisements published in the Kansas City dailies by the Kansas City Electric Light Company, in its campaign for residence business. This ad appeals particularly to parents and secured several contracts.

Open Offices and Approachable Officials as Central-Station Publicity Policy.

A publicity idea original with the Columbus Railway & Light Company, Columbus, O., is claimed by the officials to be a great success. Though a good advertisement in itself, the term publicity in this instance refers particularly to the manner in which the offices of its service departments are exposed to patrons.

These offices occupy a large, centrally located room on the street floor, and are frequented by people on all matters pertaining to commercial power and light, and to the demonstration and sale of electrical devices, household and otherwise. The greater portion of the floor space is divided off into a number of separate rooms, with glass partitions, for the convenience of different branches. Instead, however, of the glass being opaque, as is usual, it is of crystal clearness. The whole office force is thus visible at a glance.

The office of the manager is in the extreme rear. A visitor who may know him by sight does not have to ask if he is in. If the visitor is posted on the rules of the place he does not hesitate to break in upon the manager unannounced, even though the latter may be in conference with someone else. Even in the case of a stranger there is no such thing as sending in a card or a name. The clerk at the information window, after assuring himself by a turn of the head that the manager is at his desk, invites the visitor to help himself to an interview, merely directing him to the right door.

"In planning these offices we visited other cities for ideas, but finding nothing that just suited us, we worked out this system ourselves," explained Manager W. A. Wolls. "It helps to emphasize two points which we aim to keep prominently before the public. One is that we are open and above board in all our dealings with them, and the other is that we appreciate their patronage.

This office arrangement is a wonderful help. In the first place I never have anything to say to one person that I am not willing others should not hear. Thus it is no embarrassment to me if there are half a dozen people sitting around while I am talking to a man. In fact their presence is an assistance, rather than a hindrance. The person with whom I am engaged will naturally limit the interview to the necessities of the case when other people are waiting just at hand. This conserves my time. Again, it creates confidence in the mind of a third person to have any question freely discussed in his hearing. Possibly it touches upon something about which he himself has called to be informed, and in this way I may be answering his questions while talking directly to another person. To be sure, there is an occasional instance where a caller has an installation in mind which for some special reason he wishes to keep private, but we can take care of him satisfactorily without allowing our system to be interferred with."

Another important point, according to Manager Wolls, is that no caller can feel that he is kept needlessly waiting for an interview. If the manager is buried out of sight the person is compelled to sit in the dark, so to speak, for perhaps ten or fifteen minutes, is in a less reasonable frame of mind when finally admitted to the manager than if he had been able to see and hear what was going on.

"The natural attitude of nine-tenths of the public toward a public service corporation is negative," claims Mr. Wolls. Anything we can do to win people to the opposite viewpoint, by making them feel that we consider their interests our interests, increases business and decreases friction and expense."

Electric Vehicle Data

Electrics in the Wholesale Confectionery Trade.

Clean delivery, promptness and reliability are the prime requisites of a delivery system for the wholesale confectioner. As a result of these requirements this business offers one of the best fields for the electric vehicle as its superiority in these characteristics is now universally conceded.

Regular and dependable deliveries is absolutely essential in the proper conduct of the confectioner's business, as the goods must be delivered as soon as they come from the kitchens so as to insure a fresh stock to the retailer. For the same reason the deliveries must be made on schedule time and at regular intervals as the retailer usually orders at the last minute so as to take advantage of freshly made goods.

Practically the same conditions have to be met in the cigar business, as the success of most establishments depends upon the freshness of the cigars and tobacco delivered to the retail trade.

The data presented this week on this page relate to one of the 1,000-pound delivery wagons operated by J. L. Marcero & Company, of Detroit, Mich., wholesale confectioners and cigar dealers. The figures on total operating cost per month, while satisfactory when the service preformed by this vehicle is considered, are higher for 1913 than ordinarily because of two unavoidable accidents that occured during the year, necessitating repairs and renewals otherwise not required.

The cost of electric power, $45 per month, includes storage and washing as this is a flat rate charged by a public garage where the vehicle is kept.

The degree of satisfaction which this car is giving is indicated by the comments of the user as follows: "Our business with both electric and gasoline cars has been that the electric is cheaper on account of same being dependable and always on the job."

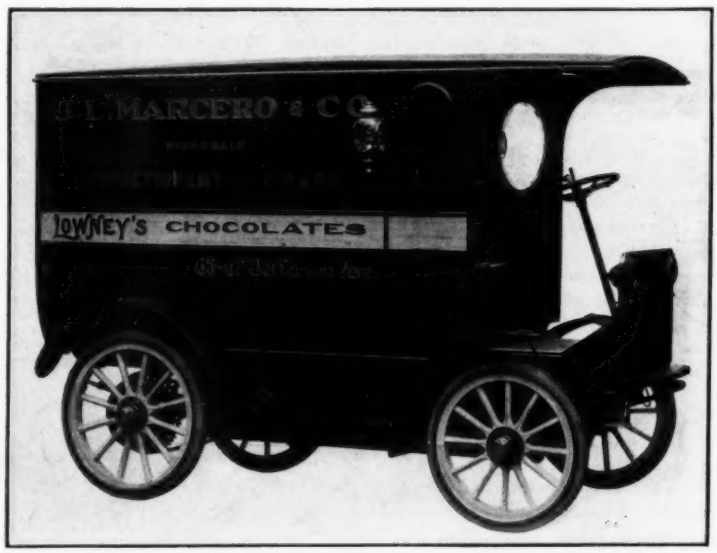
The Edison Electric Illuminating Company of Boston, Mass., has recently added six two-ton trucks to its already imposing fleet. These new trucks are equipped with electrically driven winches for pulling cables through street conduit, raising poles or running wire. In loading they can easily lift a ton or more from the ground to the truck bodies. The trucks are of General Vehicle manufacture.

Preliminary tests with a wireless receiving equipment, installed by the Marconi Wireless Telegraph Company, of Baltimore, Md., were made recently between the American Building wireless station and an electric truck used by the Electrical Commission for pumping water from manholes throughout the city.

According to *Power Wagon*, wireless signals were received by the truck equipment as far as seven miles in the suburbs, also while the car was running and standing at the manholes, in the city limits. The equipment consists of a standard Marconi receiving apparatus, similar in detail to the equipment used on board merchant vessels. The receiving antenna consists of about 25 insulated wires hung in the roof of the car, directly under the cover. The frame of the truck acts as the earth connection, although it is insulated from the ground by the rubber tires.

On motor trucks the value of the system, as a means of saving time and wear and tear, is obvious, and while no steps have been taken to install the system generally, the unqualified success of the Electrical Commission's equipment indicates that it will not be long before the big houses of the city will fall in line.

A bill appropriating $25,000 for the purchase of five electric buses has been recommended by the City Utilities Committee of the Seattle (Wash.) City Council



GENERAL.

Name of Company—J. L. Marcero & Company, Detroit, Mich.
Business—Wholesale Confectionery and Cigars.
Capacity of Vehicle—1,000 pounds.
Approximate Price—$2,500.
Make of Tires—Firestone (solid).
Battery—Edison.
Date of Purchase—1911.
Make of Vehicle—Detroit Electric.

OPERATING DATA.

Average Daily Mileage—50.
Daily Hours in Use—10.
Cost of Electric Power, Per Month, $45, Including Storage and Washing.
Days in Service, Per Month—26.
Driver's Salary Per Month—$60.
Cost of Repairs and Renewals for 12 Months—$460.

TOTAL AVERAGE MONTHLY OPERATING COST—$143.

Electrical Construction

WIRING FOR COAL-HANDLING MONORAIL CRANES.

By George Gorman.

Monorail cranes are used extensively in industrial plant practice for telpherage where the area that is to be served is a narrow path. These cranes are supported by and run on the lower flanges of an overhead I-beam rail of

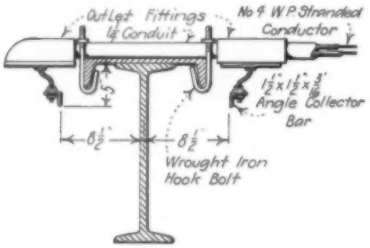


Fig. 1.—Method of Fastening Conduit to Crane Runway and of Connecting Conductors to Contact Rails.

standard section. In the installation to be described, two runways were served with electricity. One runway, 184 feet long (XX), extended along in front of a battery of six boilers, and the crane on this runway delivered the crushed coal to the boilers. The other runway (YY) was located between the coal-storage and the boiler house, and the crane on it was used to bring the coal from the storage into the boiler house. The coal was delivered either in the river in barges or on the railroad siding in gondolas to the coal storage, which was a long rectangular basin, and was taken from the barges or gondolas by a steam locomotive grab bucket crane. This locomotive crane was so arranged that it could convey coal from any point along the length of the storage to one directly under the runway YY.

The grab bucket crane on the runway then conveyed the coal to a location within the boiler house. At this point the run-of-mine coal was first weighed, then dumped into a crusher, which reduced it to pea size. From the crusher the coal was delivered to a pit in the boiler-room floor. From this pit the crushed coal was taken as needed by the crane operating on the runway XX and delivered to the boilers.

The collector conductors extending along both of the runways by which the cranes were supplied with electricity, where 1.5-by-1.5-by-0.19-inch steel angles as shown in Fig. 1, which also shows a section of the crane runway. The motors were wound for 250 volts direct current, and the energy supplied was generated in a plant located in another building 900 feet distant from the boiler house.

Following the best practice, all of the inside wiring was installed in conduit, and a 300,000 circular-mil feeder was placed the entire distance from the generating station to the boiler house. The run was aerial almost to the end of the runway. From this point it was carried in two-inch conduit on the roof trusses. The left end of the boiler house was of old construction with wooden roof trusses. The conduit run was fastened to the upper faces of the trusses in this old building with a pipe strap, as shown in Fig. 2. The right end of the boiler house was of structural-steel construction. To these steel trusses the two-inch conduit was clamped with U-bolts, as shown in Fig. 3.

Fig. 3 also shows how a pull-box was inserted between the conduit run in the old building and that in the new. The roof trusses in the old building were higher than those in the new, which necessitated the insertion of either elbows or a pull-box. The pull-box was selected because it afforded a convenient opening at which the 300,000-circular-mil conductors could be drawn to and through the runs. The pull box itself was made in their own shop of one-sixteenth-inch sheet iron by the electricians. Its top, which was merely a flat plate of the same sheet iron, was held in place with stove bolts.

Fig. 4 shows a section where the No. 4 branch circuit to the runway XX was tapped from the 300,000 circular-mil feeder. The branch conductors were tapped in a conduit fitting to the larger conductors and then carried in 1.25-inch conduit to a switch and fuse box, from which the circuit extended to the collector bars on the runways.

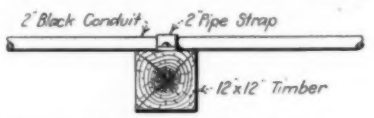


Fig. 2.—Attachment of Conduit Run to Truss Timber.

At the runways the No. 4 conductors were connected to the angle collector bars with bolts and washers as suggested in Fig. 1. Fig. 1 also shows the hook bolts and straps that were used to clamp the 1.25-inch conduit to the channel forming the upper flange of the crane runway. Conduit fittings were used at each point where the conductors were carried out of the conduit to the collector angles.

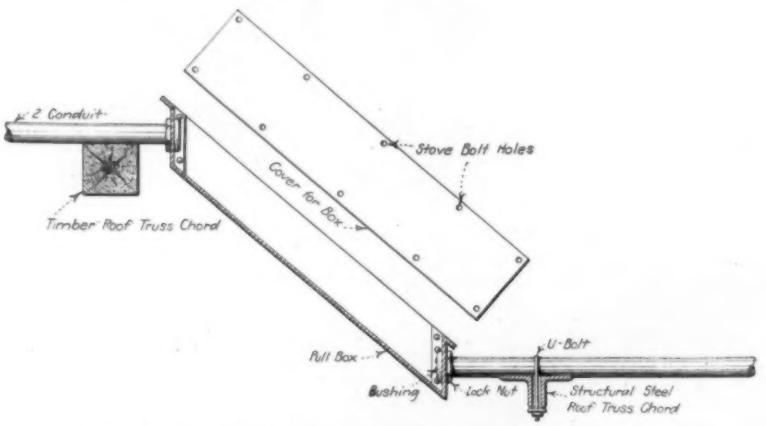


Fig. 3.—Pull Box Between Conduit Runs in New and Old Buildings.

The switch and fuses within the box, Fig. 4, were used to provide a testing and protection station from runway XX. Although this box was located high above the floor about on a level with the lower chords of the roof

trusses, a platform was arranged under it, and a ladder extended from the platform to the floor. In case of trouble on the runway XX, the repair man could open the switch in this box and thereby completely isolate the runway XX from the rest of the system, and make his tests for ground or short-circuits without interference.

Another equipment identical with that of Fig. 4, except as to arrangement, was installed to serve the runway YY. Near the junction of the two runways a 1.25-inch conduit, carrying a No. 4 wire, was placed. The 300,000-circular-mil conductors were carried to the end of the building, it being the intention to extend them to serve other crane runways at some future time when increase in the size of the plant necessitates an extension of the boiler-house building.

The following indicates the basis upon which the 300,000-circular-mil conductors were selected for this installation.

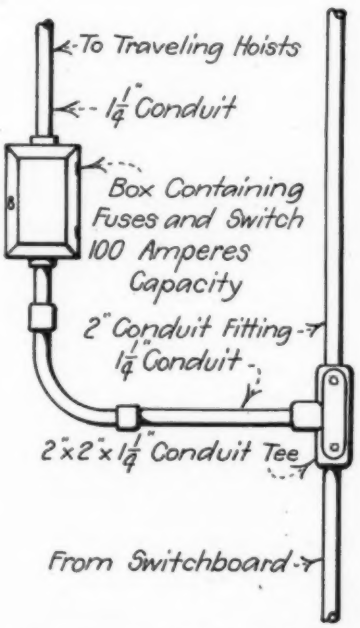


Fig. 4.—Arrangement of Conduits and Switch Box.

Single distance of circuit, 900 feet; 2 present cranes, 81 amperes, each, 162 amperes; 2 future cranes, 162 amperes; total, 324 amperes.

Assumed ratio of connected load to average load, 0.6.

Average working current (0.6x324), 194 amperes.

Allowable volts drop, 5 per cent of 250, 12.5 volts.

Using the accepted formula: Circular mils=$22Il/V$=$22 \times 194 \times 900/12.5$= 3,841,200/12.5=308,000, say, 300,000.

A 300,000-circular mil rubber-insulated conductor is good for 275 amperes, hence will safely carry the 194 amperes.

Specifications for Residence Wiring.

Specifications for the electrical wiring of any type of building should always be accompanied by plans showing the location of outlets, switches, etc., and by a list of the same, giving capacity of each outlet, types of switches, number of circuits required, etc. In addition to these particulars, which will vary with each installation, it is convenient to have a form of general specification covering items of a general nature.

The Electrical News has recently given a sample specification for the wiring of a typical residence building, which contains the following clauses:

Specifications.

These specifications are intended to cover the supply of all necessary material and labor for the installation of a complete wiring system for lighting, etc., in the new residence for John Doe in Toronto.

Working Conditions.

1. House is built and roofed but not finished. Electrical work may be started immediately.

2. House is of standard brick construction.

Plans.

Plan No. C-38 shows the "Wiring Plan of Residence," and shall be considered as forming an integral part of these specifications.

Circuits are indicated by single heavy lines, the number of wires in each run being marked by small numbers.

In all cases, circuits are located between the ceiling of the floor, on which they are shown, and the floor above.

Detail Specifications.

1. Install standard service pipe in rear of house, as shown, same to consists of three No. 8 wires in one-inch conduit.

2. Install meter board 3 feet wide by 2 feet high, covered with a clear sheet of one-quarter-inch asbestos, painted black.

3. On meter board install one three-pole single-throw, 250-volt, 60-ampere knife switch and five 3-to-2-wire double-branch fuse blocks with fuses and make all necessary connections ready for meter.

4. Install 10 branch circuits throughout the house as shown on the plan and detailed in the following summary:

Location of Outlets.

1. Ceiling outlets must be accurately located so as to bear a proper relation to decorative detail.

2. Bracket outlets in all closets to be located immediately above the center of the doorways. (It is intended to equip these with pull receptacles.)

3. Other bracket outlets in pantry and top landing to be located 5 feet 6 inches above floor.

4. Baseboard receptacles to be mounted 6 inches above floor, except kitchen and back veranda, which are 6 feet above floor.

5. Switch outlet to be mounted 4 feet above floor unless special wall details require otherwise.

6. In any case where the direction of door swing is reversed from that shown on the plan, the switch must be changed to the opposite side correspondingly.

7. Switch outlets located on any paneled wall must be carefully centered.

Control.

1. All switches indicated on the plan will be of a standard single-pole type controlling one outlet only, with the following exceptions:

(1) Both laundry outlets to be controlled together by the same switch.

(2) Rear entrance and basement hall to be controlled together by the same switch at pantry door.

(3) Main hall to be controlled by a pair of three-way switches in lower and upper halls and also with a single-button, three-way switch serving as an electrolier switch.

(4) Upper hall and intermediate landing to be connected in parallel and controlled together by a pair of three-way switches in lower and upper halls.

(5) Dining room to have a two-circuit electrolier switch.

Fittings.

1. Switches.

(1) Basement switches to be rotary snap switches of approved type.

(2) All other switches to be push-button switches of best quality Perkins or equivalent.

(3) Electrolier switch for hall to be a single-button three-way push switch, Perkins Type 0 No. 2458 or equivalent.

(4) Electrolier switch for dining room to be single-button, two-circuit push switch, Perkins Type 0 No. 2460 or equivalent.

2. Switch Plates.

(1) All switch plates to be nickel finished unless otherwise required to agree with room hardware.

(2) Upper hall plate to be standard two-gang plate.

(3) Lower hall plate to be a single plate providing for 4 two-button switches and one single-button switch, Perkins No. 3655 or equivalent.

3. Basebard Receptacles.
   (1) All baseboard receptacles to be uniform and of best quality Diamond H or equivalent.
   (2) No plugs to be supplied.
   (3) Finish of face plates to agree with other hardware of room.

1. The "General Conditions" attached herewith shall be considered as forming an integral part of these specifications.

2. All materials and workmanship shall conform to the requirements of the National Electrical Code and certificate from local inspection bureau to be furnished at the completion of the work.

General Conditions.

1. These general conditions shall be considered as forming an integral part of any specification to which they may be attached and shall be absolutely binding in carrying out any contract awarded in accordance with such specifications.

2. The following interpretations shall be taken of terms used throughout the specifications:

The Proprietor means the party or parties who own the building or properties in which the contract is to be fulfilled, in this case, John Doe.

The Contractor means the party or parties to whom any contract may be let on the basis of these specifications.

The Architect means the individual or firm under whose charge the building work is being carried on and who is exercising supervision over any or all trades which may be doing their work at the same time as the work called for under these specifications. In this case Jones and Smith.

The Engineer means the individual or firm who has drawn up these specifications and under whose supervision any contract awarded on the basis of such specifications must be carried out, namely Ewart & Jacob.

3. The contractor (unless otherwise specified), shall provide all materials, workmanship, plant, scaffolding, carriages, freightage and every other matter that may be required for the proper performance and completion of the work and the whole of which are to be the best of their several kinds.

4. The plans accompanying these specifications shall be considered an integral part of the same. Specifications and accompanying plans are intended to co-operate, so that any work shown on the plans and not mentioned in these specifications, or vice versa, is to be executed the same as if set forth by the plans and mentioned in these specifications.

5. Should any drawings or figures be omitted in the plans and details, which are necessary to a clear, comprehensive understanding, or should any error appear in either plans or specifications, it shall be the duty of the contractor to notify the engineers in writing of such omission or error before submitting tender and in no case proceed in uncertainty with the work.

6. If in the opinion of the contractor a change of plans or specifications should be made for the proper completion of the work and if such change alters in any way the original amount of the tender, the contractor must notify the engineers and submit price in writing for approval before starting the work, otherwise the engineers will not recognize any change in plans or specifications and no claim for extra payment will be allowed.

7. The plans accompanying these specifications are made as accurate as possible, but absolute accuracy of dimensions cannot be guaranteed. No claim for extra payment on account of difference of actual and estimated dimensions shall be allowed, unless such difference arises through alteration of building plans by the architect, or unless such difference shall be greater in amount than ten per centum in each case. On all plans figured dimensions are to be taken in preference to measurement by scale and drawings on a large scale are to be taken in preference to those on a small scale.

8. On all plans, the correct size, location and nature of all walls, partitions or obstructions of any kind are indicated as accurately as possible. If any additional obstacles are encountered the contractor must make good all work through or around such obstacles the same as if they had been originally indicated and no extra claim shall be allowed on account of such obstacles.

9. The contractor shall at his own cost make good any defects, settlements, shrinkages, burn-outs, grounds or other faults in his work, arising from defective or improper materials, which may appear within twelve months after the completion of the contract.

10. The engineer reserves the right to reject any and all materials which, in his opinion, are unsuitable for the proper completion of the work, or not in accordance with these specifications or accompanying plans. Such rejected materials must be removed from the premises forthwith, and if used after such rejection the contractor shall, at his own cost, tear down such materials and replace same with approved materials.

11. Successful contractor shall be required to sign the specifications and accompanying plans as well as revised contract form in which shall be stated manner of payment, time limit, amount of tender, etc.

12. The proprietor reserves the right to accept or reject any or all bids presented in determining to whom said contract will be awarded. The tenderer's reputation, as well as the amount of his proposal, will be considered and the contract made in accordance therewith.

13. The contractor will notify the engineer in writing when his contract is completed. This dated letter will be necessary to obtain his final certificate, which will be issued within thirty days after notification, if the engineer, on inspecting the work, considers the same complete.

Nature of Work.

1. All work shall be standard knob-and-tube construction, in all respects of the most up-to-date practice and best workmanship.

2. All wires brought down walls of basement to switches, etc., must be run in metal molding.

Comments on the Specifications.

No mention is made in the specifications of wiring for bells or annunciators, but this is a matter about which individual tastes differ very widely. In the particular house under discussion the front door is connected with one bell and the back door with another; the dining room and living room are connected to the same buzzer. In a house of this size upstairs bells hardly seem to be necessary though some householders prefer one push button at least upstairs, which might, in this case, be connected with the front door bell. In the dining room connection is made with a push button in the table through a floor outlet, and a push button in the living room is so located that it is easily accessible from the front veranda. Again it is a matter of individual taste whether these bells should be operated off different batteries or a transformer. The strictly modern installation would use the transformer, but where small economics are a consideration it is possible that batteries will be favored.

The baseboard receptacles in this plan are kept on separate circuits by themselves. This arrangement gives two circuits in every room so that in the event of an interruption on one circuit the room will not be left entirely without service and a fuse being blown by a fault developing in a worn flexible cord will not interrupt the lighting of any regular ceiling outlet. This gives a somewhat larger number of circuits than is absolutely necessary and takes a few feet more of wire, but it has the advantage of allowing a liberal capacity on every circuit so that if an unexpectedly large load is taken

from any outlet that circuit is not likely to be dangerously overloaded.

A small wall lamp is provided above the door in each closet. The additional expense for these outlets is very small, the current consumption will be negligible and the added convenience is very material indeed. Especially where clothing or supplies is placed on shelves a good lighting is necessary to maintain a proper tidiness.

In the back veranda and in the kitchen, where ironing is most likely to be done, outlets have been placed 6 feet from the floor so that the ironing cord will not interfere with the work. These outlets are equally valuable for any other apparatus.

A liberal number of baseboard receptacles are installed at convenient places. These will carry lamps, toasters, water-heaters and, above all, small electric heaters for spring and autmun use before the furnace is operating. A receptacle has been placed on the front veranda as this, if windowed, is most likely to be the place where an afternoon tea or a lazy breakfast will be served. The floor plug in the dining room is also calculated to supply a sufficient number of electric utensils to cook a small meal. The plan suggested is to connect a plug in the floor with two or more flush plugs at convenient points in the table. The unsightly appearance of a number of cables hanging from the electrolier is thus avoided. The floor contact also is a permanent one and need only be removed in case the table is to be moved a considerable distance. The two additional baseboard outlets at the sideboard and buffet will admit either of decorative lighting or frying operations which might spoil the table linen.

Safety in Electric Wiring.

From 7 to 15 per cent of our fires are electrical in origin and our per capita loss from all fires is from $2.40 to $2.60 per annum, exclusive of the cost of fire departments, according to F. C. Green, secretary of the Oregon Electrical Contractors' Association, in a recent address to the Oregon Society of Engineers. Using average figures the annual loss due to defective wiring in Oregon is therefore approximately $190,000. This loss is one that can be and should be remedied.

The question, of course, will naturally be asked, Why do not responsible, reliable electrical men get busy and eliminate the incompetents? This is just what we have been trying to do. Through combined efforts of the electrical interests, we now have an electrical ordinance and inspection department which is in the main good. There is, however, no test of fitness, the only requirement being the ability to get $5.00 with which to secure a bond. The problem, however, is not a local one and should be handled by the state and an examining board created with power to issue and also to revoke licenses whenever inferior and hazardous work is shown.

The Oregon Electrical Contractors' Association has prepared such a bill. This bill will not prevent a man from wiring his own house, and manufacturing concerns or any corporation can have their engineers do their wiring, providing first that he takes the examination and becomes a qualified "master electrician." This bill will not keep any one out of the electrical business who is competent to be in the business. This bill will protect the property owner from incompetent and unscrupulous contractors by providing a bond whereby the owner can recover in case work is not properly performed. This bill will not be a burden to the taxpayers, as it is entirely self-supporting. In other words, we are not attempting to create an electrical trust and unless we can convince others than ourselves, who naturally have a selfish interest in this matter, we shall deservedly fail. I trust, therefore, that when the time comes, the Oregon Electrical Contractors' Association can receive a hearing and also receive endorsement to this measure.

Among the Contractors.

The Central Electric Company, Detroit, Mich., has the contract for wiring the new Sanders' Confectionery store and candy manufacturing plant on Woodward Avenue, near Winder Street, Detroit.

Sweeney & Sacre have been awarded the contract for wiring Duncan Park by the City Commission of Lexington, Ky., their bid of $195 being the lowest.

William J. McCloud & Company, Elizabeth, N. J., have been awarded a contract by the Pennsylvania Railroad Company for the construction of a multiple-duct underground conduit along its line between Jersey City and Rahway, N. J., a distance of about 19 miles, at a cost of $50,000.

The Beaver Electric Construction Company, Chicago, Ill., will make a number of alterations in the Sans Souci Park, an amusement resort in Chicago.

The Electric Construction Company, of Little Rock, Ark., will establish a branch contracting and supply store under the name of the Electric Construction Company at 217 South Main Street, Hope, Ark., on September 15. The Electric Construction Company has been in continuous operation since 1887, and the steady growth of the business has necessitated the establishment of this branch so that the southwest Arkansas trade can be better taken care of. While all purchases will be made through the Little Rock main office, the company will be glad to have catalogs and price lists from manufacturers of standard electrical supplies mailed to its Hope branch.

Gray Brothers' Electric Company, Detroit, Mich., is wiring the new Orpheum Theater, located at the corner of La Fayette Boulevard and Shelby Street, Detroit.

Horton & Williams, Gary, Ind., will wire the Hirsh bakery of that city.

The F. M. Grant Electric Company of Cleveland, O., has been awarded the contract for both the light and power installation in the immense new factory and power house recently erected by the Parish & Bingham Company, manufacturers of automobile frames and cold stampings. The main building is 900 feet long by 100 feet wide, with traveling crane running the entire length. The power house is a separate building with a spacious tunnel connecting the two buildings, and through which all the feeder conduits will be run to the main building. The entire installation, consisting of 600 lighting outlets and a total of 700 horsepower in motors, will be in iron conduit. Power will be supplied at 440 volts and distributed from eight panel switchboards in power house. The lighting current will be distributed from 15 lighting panelboards at 110 volts, stepped down through four 440-volt transformers, with individual feeders to the main switchboard. All motors will be equipped with "Safety First" switches and overhead relays. The F. M. Grant Electric Company is also installing a complete conduit and wiring system for lights, telephones, fire gongs, etc., in the new McKinley School building in Lakewood, O.

Gas-filled tungsten lamps to illuminate the exterior of the theater have been installed at the Opera House, Augusta, Maine, by Webber & Church, local electrical contractors.

Eardley Brothers, Salt Lake City, Utah, have the contract for rewiring the Keith Building, which was formerly occupied by the Keith-O'Brien department store. It is now being subdivided and rented to tenants in smaller stores. The contract calls for the reconstruction of the main switchboard and changing its location.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

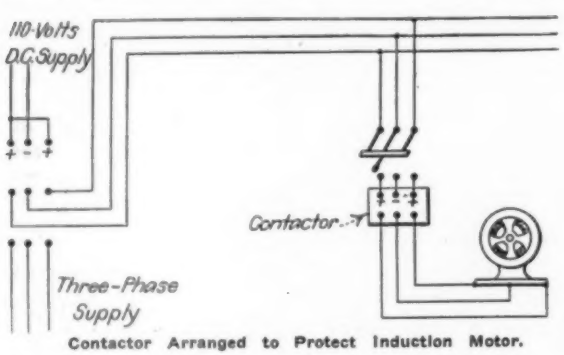
Protection for Alternating-Current Motors.

Three-phase 110-volt energy from a private plant is used in our factory for lighting and power purposes during the day. At night, however, the private plant is shut down and energy obtained from the 110-volt mains of the local lighting company. This energy is only used for lighting purposes, but there is, of course, the possibility of one working at night attempting to use one of the motors all of which are of the three-phase induction type. Throwing direct current on any of these motors would, of course, cause an excessive rush of current to the motor, blowing fuses and perhaps damaging the motor.

To prevent direct current being thrown on the motors I adopted the scheme of connections shown in the figure. It will be noticed that the two outside mains of the three-wire system are both positive and that a contactor is inserted between a motor switch and the corresponding motor. This is a three-pole contactor, actuated by a coil connected in shunt across the two outside mains. When the motor switch is closed and alternating current is being supplied the contactor will close because its coil is connected across two wires of the three-phase system.

However, when direct current is being supplied the contactor will not close because its coil is connected across the two outside mains which are of the same polarity. Hence it is impossible to throw direct current on the motor. These contactors are employed in connection with every motor in the shop.

H. A. Bridge.



Contactor Arranged to Protect Induction Motor.

Channeling in Brick.

I once had to wire a brick theater building in which there was much brick channeling to be done. The usual method of using a brick chisel and hammer was too slow and tiresome so I decided to use a miner's pole pick. This is a pick having a point on one side of the handle and a hammer for breaking rock on the other side. I took this pick to the blacksmith and had him make the point into a chisel, with the cutting edge at right angles to the handle, and the hammer end into a semi-circular chisel or gouge. With this pick, using the chisel end to make the channel and the gouge to smooth it, I could make channel about five times as fast and much more easily than by the hammer-and-chisel method.

Tool for Channeling in Brick.

George I. James.

A Substitute for an Annunciator.

It sometimes happens that a house has a front and back doorbell both of the same make and tone. Unless an annunciator is installed it is hard to distinguish one bell from the other. To overcome the objection put the two bells close together so that the hammer of one bell will strike both gongs and the hammer of the other will strike only one gong. The bell utilizing both gongs will give a different sound than the other.

William T. Estlick.

Wiring in Close Quarters.

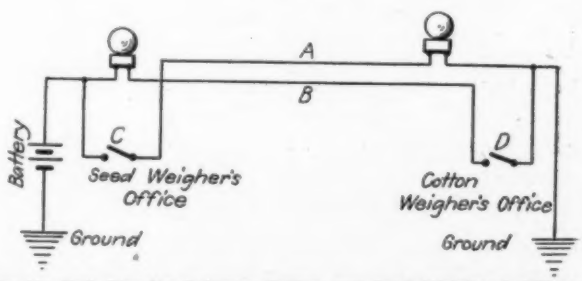
I recently had to rewire an office building having a flat roof the clearance between the roof and the ceiling running from four feet at the front to nothing at the back. After three or four hours crawling around in such close quarters I was exhausted and had accomplished very little. I then decided to use a piece of board 12 inches wide and about eight feet long and surfaced on both sides. With my knife I rounded the edges of one side, and then greased this side with soap and nailed a small box upon the other side at one end, to hold my knobs and tools. I now laid this board, soaped side down, upon the ceiling joists and laid myself flat upon it. By taking hold of the joists with my hands I could slide around rapidly and with very little effort and could get back just as far as there was room for my head to pass sideways between the roof and ceiling joists. By this means I finished the job with less expenditure of energy than I often put into the average job.

George I. James.

Double Bell Circuits on One Battery.

The seed-weigher's office and the cotton-weigher's office of a plant are 300 feet apart. At present a push-button in the seed-weigher's office is used to ring a bell in the cotton weigher's office. However, it is desirable to also make it possible to signal from the cotton-weigher's office to the seed-weigher's office. Not wanting to run any additional line wires, I employed the scheme of connections shown in the sketch utilizing a hydrant as one ground and a telephone lightning-arrester ground as the other. The wires *A* and *B* are the original line wires, and *C* and *D* are push-buttons. The depressing of either push-button rings the bell at the other office as can easily be seen.

V. L. Martin.



Double Bell Circuits Between Cotton and Seed Weighers' Offices.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

The Pacific Gas & Electric Company was ordered to reduce the primary rate for electricity in the San Jose district from 8 cents for the first 30 kilowatt-hours to 7 cents for the first 20 kilowatt-hours, and other rates were proportionally reduced. No change was made in rates for power. The decision also provides that the Pacific Gas & Electric Company shall, at its own expense, upon written demand, make extensions of its electric service whenever required, within the city limits of San Jose, Los Gatos and Sunnyvale and within the unincorporated territory in the San Jose district.

The Bay Cities Home Telephone Company was authorized to transfer its franchise, granted by the town of Berkeley, to the Pacific Telephone and Telegraph Company and the latter company was granted a certificate of convenience and necessity to operate under the terms of the franchise.

The Oro Electric Corporation has been authorized to issue its promissory notes to the sum of $82,058.25, to renew notes now due. The Commission specifies that the face value of the notes issued shall not exceed the face value of the notes renewed; the rates of interest of the notes issued shall not exceed seven per cent per annum, nor the term of any note extend beyond September 15, 1915; the company shall make a verified report to the Commission of all notes issued in accordance with this order, specifying the notes which have been renewed thereby; and that the authority granted shall apply only to notes issued on or before December 31, 1914.

Marin Water & Power Company. The Railroad Commission has held hearings on the valuation of the property of the Marin Water & Power Company and the North Coast Power Company. This is in connection with the proposed purchase of their properties by the Marin County Water District.

INDIANA.

The Franklin Water, Light and Power was authorized to increase its rates from $1.00 to $1.10 a month, where bills are not paid before the tenth of the month.

The Franklin Water, Light and Power Company was authorized to issue $19,000 in bonds.

The United Gas and Electric Company of New Albany and Jeffersonville was authorized to issue $25,000 in bonds.

OHIO.

The Hocking Valley Railroad Company, finding that the operation of its electric railway line between Jackson and Hamden was less profitable than formerly, abandoned the service and substituted steam trains. The communities along the line which were dependent upon this company for electric light and power service were left without such service. The commission ordered the electric service restored and the decision holds that after a utility has gone into a community, offered a service, supplied it for years, and the community has developed to the modern trend of the service, it cannot at will withdraw and leave that developed community without the service. It also affirmed the decision that railway systems may not abandon one section of property and discommode a community because that particular section is unprofitable, when the system as a whole is prosperous and profitable.

PENNSYLVANIA.

The Erie County Electric Company in a decision rendered September 5, upon complaint of James Thompson and M. A. Hanna and Company, the Commission upholds the right of the power company to classify its customers and differentiate in its charges.

The opinion states: "It has long been recognized in the manufacture of electricity that irregularity in the current demands of a customer results in the least desirable class of business owing to the necessity for making provision for furnishing sufficient service at the time of greatest requirements for same and then having a greater or less portion of the power station equipment idle at other times, when the customer has no need of the full amount that provision has been made for. Another difficult service to maintain is where the requirements are subject to sudden and recurring wide fluctuations. In such cases unusual precautions and provisions are required at the generating station to prevent the variable demands of one customer, unless served from an individual generator, affecting adversely the regularity of the voltage and current furnished to all other customers."

Edison Electric Company. The Commission approved an ordinance of the city of Lancaster granting the Edison Company the right to maintain an underground conduit system in that city.

WISCONSIN.

La Crosse Telephone Company. The respondent telephone companies in the case of Frank Winter, La Crosse Telephone Company and Wisconsin Telephone Company (12 W. R. C. R. 748) have been unable to agree upon the manner of providing physical connection required in the Commission's order, the joint toll charges to be made, and the apportionment of the toll charges between the companies. The Commission issued a supplemental report and order on August 20 specifying a tentative method of connection and fixing the charges to be exacted upon a zone basis as follows: for all distances of not over 50 miles from the office of the company, 5 cents; for all distances over 50 miles and not over 100 miles from such office, 10 cents; and for all distances over 100 miles from such office, 15 cents. All distances are to be measured by air line. The decision provides that "neither of the companies shall absorb any such additional charges, but shall collect the same from its subscribers; but each of the companies shall be liable to the other and shall pay to the other the long-distance tariff toll plus such additional charge." If the division of tolls, after a fair trial, is found to be inequitable, and the companies do not agree upon a proper division of the tolls, the Commission will by supplemental order, establish such division.

The New Union Telephone Company. The Commission has issued an order fixing a division, between the New Lisbon Telephone Company and the Mineral Point Telephone Company, of the tolls collected over the toll line running from Dodgeville to Mineral Point. The decision points out the fallacy of the contention of the Mineral Point Company that the service furnished by that company, because it has a larger exchange, is more valuable than the

service furnished by the New Lisbon Company. The division of the tolls determined upon by the Commission is fixed upon the basis of cost to the companies in furnishing the service.

The Nebagamon Telephone Company was ordered to improve service conditions on its line. The number of subscribers of the company has decreased owing to the decrease in the population of the town. The company is not in a strong financial position and cooperation between the subscribers and the company in improving service conditions is encouraged by the Commission.

Telephone in Railway Station. The telephone company discontinued free telephone service in the station at Shell Lake, which action, according to the railway company, was in violation of a contract between the telephone and railway companies. The Commission finds that unlimited service at the Shell Lake depot is necessary for the reasonable accommodation and convenience of the patrons of the railway company in the transaction of railway business. The decision says: "The public may not be inconvenienced because of a controversy between the railway company and the telephone company as to the validity of the contract in question. If the telephone company has breached such contract the remedy therefor must be sought in the courts. This commission is not authorized to pass upon the validity of private contracts entered into by public utilities with their patrons with a view of rendering judgments specifically enforcing the same or granting damages for their breach, if found to be valid."

The Weyauwega Electric Company was authorized to issue $40,000 of bonds and $10,000 of stock for the purpose of making necessary improvements and extensions.

Janesville Water Company. The Wisconsin Railroad Commission has held hearings on the valuation of the Janesville Water Company's property. The city recently voted to take over the property of the company.

Among the Supply Men

The F. Bissell Company's Salesmen's Conference.

Coming from Ohio, Michigan, Indiana, West Virginia, Western New York and Pennsylvania and parts of Illinois and Kentucky, 30 or more salesmen of the F. Bissell Company gathered at Nela Park, Cleveland, O., to take part in the semi-annual salesmen's conference which this year was held from September 3 to September 7. Those men whose sales have amounted to their yearly quota journeyed to Cedar Point and spent one day in fun and frolic. From Cedar Point they went to Nela Park, where the general sales conference was held, at which matters of interest to the customers, salesmen and the house were discussed and gone thoroughly into. While these meetings meant the discussion of serious subjects, at the same time there was no lack of enjoyment and sport. Sleeping in tents, playing tennis, baseball, quoits, etc., and swimming and bathing are a few of the many pleasures that were enjoyed.

Philadelphians Promote Latin-American Trade.

The electrical supply trade of Philadelphia was amply represented at one of the most momentous meetings ever called to consider the problem of trade expansion. Approximately 400 merchants and manufacturers were assembled at a meeting called by the Philadelphia Commercial Museum. Wonderful opportunities in South America are opened to the American manufacturer, which included every line of trade and industry, and the subject of aiding business to push its way into Latin-America was thoroughly discussed.

Early Electrical Christmas Campaigns.

The retail store of the Western Electric Company in Cincinnati, O., has earned the distinction of being first in the field, in that city, at least, in the annual attack on the purse of the Christmas shopper. It made a very attractive window display last week, with a sign bearing the injunction, "Do Your Christmas Shopping Early," consisting of various electrical toys. A miniature aeroplane, fixed to a lamp bracket so as to swing in a circle in the center of the window, served to attract the attention of passers-by, while the toys themselves, such as electrically operated miniature fountains, grist mills, saw mills, machine shops, elevators, and the like, formed an interesting and unusual display. Of course, the extremely early date at which the display was made was in itself a guarantee that it would attract unusual attention, and there is little doubt but what sales will result from it, now as well as later on, when Christmas shopping reaches its greatest activity.

Electric Appliance Company of Chicago to Have Big Field Day.

The Electric Appliance Company, of Chicago, will give a picnic for its employees and their families and friends on Saturday, September 19, at Hudson Lake, Ind. W. W. Low, president of the company, has announced that no work will be done upon that day, and the party with its host will assemble at the Randolph Street station of the Illinois Central Railroad at 9:00 o'clock in the morning and a special through train will run directly to Hudson Lake. The train will leave Hudson Lake at 7:55 p. m., arriving back in Chicago about 11:00 o'clock.

There will be a base ball game and other athletic events for both the men and women employees, and a large number of valuable prizes have been secured for the winners.

The electrical supply firm of Powell & Dunne, Grand Rapids, Mich., has been dissolved, Mr. Powell retaining the business.

W. W. Low, president of the Electric Appliance Company, Chicago, Ill., states that while the company is not conducting a campaign on any particular line, it is using its best efforts to promote the sales of the entire line of electrical supplies. Mr. Low is pleased to advise that during the past six weeks or two months business has been coming in in much better shape than at any time during the year.

Edward S. Snover, for several years manager of the Toledo Electric Sales Company, of Toledo, O., has severed his connection with that company to enter the electrical jobbing field in Toledo.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 235.—Size of Rotary Converters.—What limits the size or capacity for which a rotary converter can be built? I understand that certain railways would like to use sizes larger than the manufacturers can furnish.—C. A., Washington, D. C.

No. 237.—Wireless on Aeroplanes.—Has the use of wireless as a means of communicating from aeroplanes to the ground been perfected? Is it being employed by aeroplane scouts in the present European war?—T. F. S., Augusta, Me.

No. 240.—Life of Gas-Filled Tungsten Lamps.—What is the longest life record as yet attained on test or in servive with the new nitrogen-filled tungsten lamps?—P. C. U., Springfield, O.

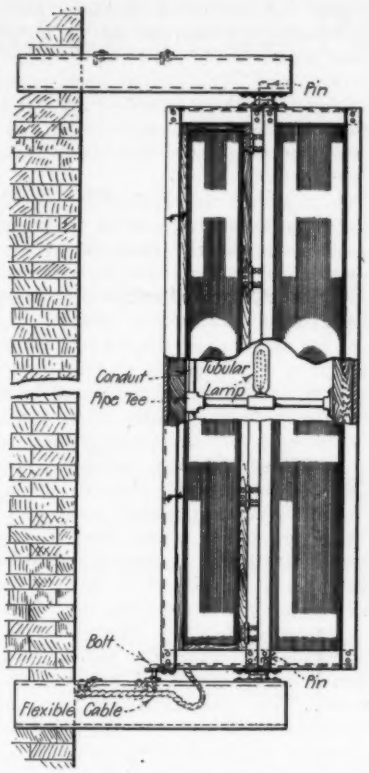
No. 241.—Electricians in Mexico.—Do any of your readers know what are the prospects for an electrician in Mexico, assuming that country to have settled down to a state of peace and industrial development?—N. D. G., Oklahoma City, Okla.

No. 242.—Extension of Central-Station Lines.—Is there any established rule by state commissions requiring a central-station company to extend its distribution lines to a thinly settled residence district near the city limits where for many years there probably would not be more than an average of one customer per block?—B. M. S., Indianapolis, Ind.

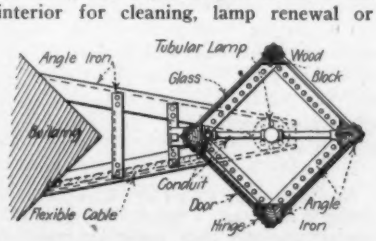
Answers.

No. 234.—Vertical Electric Sign.—In the case of a vertical electric sign of box section, about one foot square and about 12 feet high, that is to be mounted on the corner of a hotel building and have lettering on all four sides so as to be easily read from any direction on the intersecting streets, how should the lamps be arranged to get all parts of the letters uniformly lighted and yet use a minimum number of lamps?—C. L. T., Brooklyn, N. Y.

In your issue of August 29 I saw an answer to this problem that did not seem to me the simplest possible solution. I would propose to use a single row of long tubular lamps arranged one over the other, as shown in the sketches herewith. These lamps would be in the center or axis of the sign, so that they would light up all its four sides very evenly. Ten to twelve 60 or 100-watt tungsten lamps would be used, depending on the degree of translucence of the letter portions of the glass sides. The best results would be obtained by making the letters of smooth opal or milk glass blocked out with a black background. The inside of the sign should be painted white (except on the translucent letters) to reflect the light onto the letters. The wiring in the sign consists of a single vertical conduit in one corner with a lateral branch for each lamp; this extends clear across the sign to form a diagonal brace with a condulet in the middle for a weatherproof lamp socket. The framework of the sign consists of angle irons with wood corner fillers. One face of the sign is made of sectional hinged doors secured by strong latches; these give access to the interior for cleaning, lamp renewal or repainting. The entire box is mounted on channel beams between center pins to permit turning the box for washing or repainting any face of the sign. A locking bolt is provided for clamping the sign in any of five positions, one being the normal position and the others to permit the four different outer faces to be washed or painted. A flexible steel-armored lead-covered cable with weatherproof plug and receptacle permits removing the electrical connection when the sign is to be turned for cleaning. This type of sign is especially suited for cities where horizontally projecting signs are not permitted. It can be read from all four directions of even narrow intersecting streets.—D. H. B., Evanston, Ill.



No. 234.—Vertical Electric Sign.



No. 234.—Cross Section of Sign.

No. 236.—Electrolytic Arresters.—Is there any advantage in charging an electrolytic lightning arrester through a resistance, and if so, is this advantage sufficient to warrant the expense of charging resistances for a small system?—R. M., Philadelphia, Pa.

Charging resistances are certainly of considerable value in connection with electrolytic arresters, and their expense is justified on a system, no matter how small its size, for the following reasons: (One.) Arresters with charging resistances have selective paths for the discharging. These paths are so arranged that all but the most severe disturbances are discharged through the resistance. In the event of a discharge across the main gap the arc will be intercepted by the auxiliary horn which is located directly above, and hence be broken through, the resistance. (Two.) Discharging is always performed through a resistance which limits the initial rush of charging current when the cells have been standing for 24 hours or more. (Three.) New installations of arresters, and arresters which have remained uncharged for several days, can be put into service by charging at full potential if they are equipped with charging resistances. While this latter feature may be of considerable service as an emergency measure, it should never be relied upon to take the place of the daily charging of the arrester. (Four.) The charging contacts used in conjunction with the charging resistance make direct contact at the auxiliary horn when charging, thereby eliminating arcing except at the instance of making and breaking the contact. (Five.) The elimination of the arcing, except that at making and breaking contact, and the introduction of the resistance in this path, modifies the current wave and actually reduces the value of the charging current. This greater uniformity of charge of current results in longer life of the electrolyte and the cone, thus making the charging resistances act as safety devices for any poor condition of the arrester cell. (Six.) Use of charging resistances has minimized the oscillation

caused by the charging arc. In conclusion, it might be said that the charging resistances do not sacrifice any of the valuable features of the electrolytic arrester, but by their addition the arrester is made more sensitive, reliable and durable.—M. C. H., San Francisco, Cal.

No. 238.—Reinspection of Electrical Installations.—Has any American city an ordinance or rule requiring reinspection of electrical installations every few years to insure that additions or alterations have been properly made? Is this practice actually carried out in any large city?—J. H. C., Madison, Wis.

The section of the Chicago ordinances covering electrical inspections is as follows:

"834. [Power of Commissioner of Gas and Electricity—Inspections and Reinspections.] The said Commissioner of Gas and Electricity is hereby empowered to inspect or reinspect all overhead, underground and interior wires, and apparatus conducting electric current for light, heat, or power, and when said conductors or apparatus are found to be unsafe to life or property, he shall notify the person or corporation owning, using or operating them to place the same in a safe and secure condition within forty-eight hours."

The Chicago Bureau of Electrical Inspection has seven of its many inspectors spend all their time on reinspection work. This delegation of special inspectors for reinspection has been greatly broadened during the past year, and it is expected to increase this feature of the work from time to time so as to make it eventually perhaps even more extensive than the inspection of new construction. The necessity for it is due to unauthorized alterations frequently made by inexperienced electricians who have practically no actual knowledge of the requirements; wear and tear on much electrical work also results in depreciating its quality, so that reinspection is necessary. At the present time the number of inspectors available for this reinspection work is relatively small compared to the need for inspectors of new work and therefore the reinspection is at the present time confined to installations where particular hazards are known to exist, such as factory buildings occupied by a large number of employees, especially clothing shops. The primary aim is to safeguard human life and property, as well as to reduce the cost of electrical maintenance.—F. B., Chicago, Ill.

The City Ordinance of Detroit requires that inspection of electrical equipments be made from time to time, and an inspector has access to any building at any time, to see that said equipment is kept up to a safe standard. We have at present one inspector detailed for reinspection of old installations and anticipate increasing the number as conditions seem to demand. Detroit has had a systematic reinspection of old wiring for nearly two years. The method employed is to inspect in the congested sections first and gradually work out to the more scattered sections of the city.—B. W. C., Detroit, Mich.

The ordinance under which the Cleveland department is at present operating, provides that the city electrician is empowered to inspect and reinspect all overhead, underground and interior wires and apparatus conducting electric current for any purpose whatsoever, within the limits of the city of Cleveland, and shall be empowered to make such tests as he may deem necessary, to ascertain the condition of such wires, conductors or appliances. We have no specific reinspection requirements, but at present we are making a systematic reinspection. Our permit system is such that the contractor calls in for an inspection, and as there are a number which have never been called in, we are going over these and making inspections. This means that practically the entire city will be reinspected in the course of the next few months. The time interval is from one to two years. We feel that this system of reinspection is doing a great deal of good, and we are positive that we are reaching a number of installations to which additions have been made.—E. W. P. S., Cleveland, O.

Practically all ordinances which are in use in the larger cities and covering the subject of electrical inspection provide that the inspection department shall have full authority, not only over new inspection, but also over all old installations and any additions which may be made thereto. In all of the larger cities there is a sytematic reinspection of all theater and moving-picture risks, because of the higher degree of fire and life hazard existing. In the larger cities of the Pacific Coast, which come under the writer's observation, such inspections are usually made at least once a month. In San Francisco, reinspection of large industrial plants and factories where changes would be likely to be made in the wiring without making application for the usual permits is made as often as possible, and usually at least once a year. The matter of reinspection has been agitated in New York for several years, and I understand that the Department of Water, Gas and Electricity is making inspections of old work wherever there might be reason to believe that there had been an increase in the fire hazard, due to defective electrical insulation.—M. C. H., San Francisco, Cal.

No. 239.—Potential Regulator.—About a year ago I heard of a new potential regulator that could be installed outside along the pole lines of a distribution system. What has been the experience with this type of regulator? How does it withstand the weather? Does it require frequent attention?—B. L., Kansas City, Kans.

Potential regulators similar in type to the feeder potential regulators installed in substations and suitable for use on poles and designed for outdoor installation have been on the market for at least two years. These regulators are designed along similar lines to those used in substations and are composed of an operating motor, a voltage relay and a transformer mechanism. They are mounted in a weatherproof case. Such installations as have come under the writer's observation have been entirely satisfactory. Their use has enabled a central station to maintain much closer regulations of the voltage at the consumer's premises than was possible under the old system, where the feeder regulator simply set the voltage for the center of distribution, and made no effort to take care of the drop in the transformer secondaries, many of which worked under a widely varying load, and oftentimes were many hundred feet in length.—M. C. H., San Francisco.

The regulator referred to is evidently that manufactured by the General Electric Company and which was placed on the market about 16 months ago. This type of regulator has given excellent service and, being designed for outdoor installation, has withstood all kinds of weather conditions without difficulty. It is used chiefly by larger central-station or power companies for supplying power from a transmission network to several towns, particularly where the load is not sufficiently heavy to warrant the expense of a substation building. For this purpose the pole type of transformers, switches and regulators are used. The pole-type regulator is a single-phase outfit and is installed in the same way as a pole-type transformer. It needs very little attention, it being necessary only to inspect and oil the small induction motor contained in the outfit about every two months.—H. J., Chicago, Ill.

Frankfort Street-Lighting Controversy.

Unless some compromise is made, it looks as though the quarrel between the City Council of Frankfort, Ky., and the Kentucky Public Service Company will get into the courts. The city had declined to pay the company's bill of $9,000 on the ground that the lights furnished by the company have not been up to the 2,000-candlepower requirements stipulated in the contract. The company is threatening to turn off the city lights while the Council is investigating the cost of installing and operating a municipal plant which shall enter the commercial field. The city owns $30,000 of stock in the Kentucky Public Service Company.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 1. A three-cell storage battery is charged by a generator as shown in Fig. 1. Given the following data: Electromotive force of enerator, 7.4 volts; electromotive force of each cell of battery, 2.2 volts; resistance of generator armature, 0.04 ohm; resistance of each connecting wire, 0.05 ohm; resistance of each cell, 0.02 ohm.

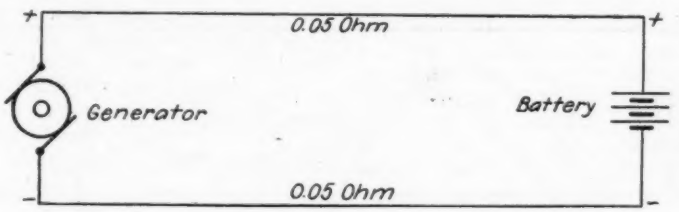


Fig. 1.

Find (*a*) resultant electromotive force in the circuit; (*b*) total resistance of the circuit; (*c*) charging current of battery; (*d*) terminal voltage of generator; (*e*) terminal voltage of battery; (*f*) total potential drop in connecting wires.

This problem is given to illustrate the principles involved in a series circuit.

SOLUTION OF PROBLEM 1.

The circuit shown in Fig. 1 is a *series* circuit and is distinguished from any other kind of circuit by the fact that a current flowing through it is at no place divided and must pass through each section or component part of the circuit with *undiminished* strength. *Current* is measured in *amperes* and denotes the rate at which electricity passes through the circuit. It should be noted that it is electricity which actually *flows* through a circuit and not the current since current indicates the *rate* at which the electricity flows. It should rather be said that a current is *established* in a circuit. The use of the term "current flows" in this series of problems is due to the long-standing general use of the term although the expression is obviously incorrect.

The primary electric pressure which causes current to flow in any circuit is called an *electromotive force* (*emf.*), and is produced (1) by constantly varying the magnetic flux surrounding a group of conductors, or (2) by placing certain substances in contact. The first method is used in all types of dynamo-electric machines, and the second method in electric batteries. An *emf.* is measured in *volts* and its direction is represented diagrammatically by + and — signs, the emf. acting from — to + within the source and from + to — outside the source. Armature reaction in a dynamo-electric machine and polarization in a battery causes the emf. produced in those sources to vary somewhat with the current. The extent of this variation may be determined in most cases only from experimental data, and in the absence of such data it must be assumed that the emf. is independent of the current. When not stated otherwise in these problems, it will be assumed that an emf. is uninfluenced by the current. When several sources of emf. exist in a series circuit, the resultant emf. (E_o) equals the algebraic sum of the component emfs. (E_1, E_2, E_3, *etc.*) or:

[1] $E_o = E_1 + E_2 + E_3$, etc.

The resultant emf. (E_o) cannot be determined in any circuit other than a series circuit.

Answer to Question a.

By equation [1], $E_o = 7.4 - 3 \times 2.2 = 7.4 - 6.6 = 0.8$ volts.

Certain materials are used in every electric circuit to conduct the current, while other materials are used to insulate the current. An insulating material differs from a conducting material only in the degree that it conducts current, since all materials conduct current to some extent. A material which, under the same conditions, conducts more current than another material is said to have a lower *resistance* than the other material. The *resistance* of any material is measured in *ohms* and depends upon the geometrical shape and chemical structure of the material. The total resistance (R_o) of a series circuit equals the sum of the resistances (R_1, R_2, R_3, etc.) of its respective sections, or:

[2] $R_o = R_1 + R_2 + R_3$, etc.

In later problems it will be shown how the magnitude of a particular emf. or resistance may be determined.

Answer to Question b.

By equation [2] $R_o = 0.04 + 0.05 + 3 \times 0.02 + 0.05 = 0.2$ ohm.

The electric pressure existing between the ends of any section of an electric circuit is called a *potential difference* or a *voltage* and is measured in volts. Given the resultant emf. (E_o), the current (I) and the resistance (R) respectively of any section of an electric circuit, the potential difference (V) between the ends of that section is given by:

[3] $V = +E_o - IR$

Where (E_o) is positive when acting in the direction of the current flow and is negative when acting in the opposite direction. A positive value of (V) indicates a *potential rise* and a negative value a *potential* drop in the direction of the current flow. When the section contains no source of emf. [3] reduces to:

[4] $V_R = -IR$

where (V_R) is called a *resistance voltage*. The negative sign shows that in such a circuit there is always a potential drop in the direction of the current.

The potential difference between the ends of any section, which is composed of any number of series sections, equals the algebraic sum of the respective potential differences between the ends of the component sections. Hence, in any section A B C, made up of the two component sections A B and B C,

[5] $V_{ABC} = +V_{AB} + V_{BC}$.

When any section of an electric circuit contains no source of emf., or the resultant emf. in any section equals zero, the current (I) flowing in that section is given by

[6] $I = V/R$ (called Ohm's Law)

where (V) is the potential difference and (R) is the resistance between the ends of the section in question. In any series circuit, if (R) equals the total resistance (R_o) of the circuit V equals the resultant emf. (E_o) of the circuit. It should be noted in this case that the circuit may be rearranged for the purpose of analysis so that one section will contain the total resistance of the circuit. In any other case if V is not given and cannot be calculated from [3] or [5] by reason of insufficient data, the determination of the current by [6] is impossible.

Answer to Question c.

For the purpose of analysis, the circuit may be divided into two sections; one which contains the total resistance (R_s), and one which contains the resultant emf. (E_s). Hence

By equation [6], $I=0.8/0.2=4.0$ amperes.

Answer to Question d.

By equation [3], $V=+7.4-4\times0.04$
$=+7.4-0.16=+7.24$
volts and is a potential rise in the direction of the current flow.

Answer to Question e.

By equation [6], $I=0.8/0.2=4.0$ amperes.
$=-6.6-.24=6.84$
volts and is a potential drop in the direction of the current flow.

Answer to Question f.

By equation [4], $V=-4.0\times0.1=-0.4$ volt and is a potential drop in the direction of the current flow.

SOLUTION OF PROBLEM 51.

Answer to Question a.

An alternating electromotive force, or current, goes through a fixed cycle of values and reverses its direction in the circuit many times a second. The ideal cycle of voltage and the one which electrical machinery is often designed to produce is called a sine wave. In this series of problems we will always assume that both the voltage and current are sine waves, unless something is said to the contrary. A common way of representing such quantities is by means of curves called the voltage and current waves, both of which are shown in Fig. 1a.

Distances along the horizontal axis are measured in seconds and in degrees, while distances along the vertical axis are measured in volts or in amperes, as the case may be. Time is measured from any point, such as O. Voltage and current are both measured from the horizontal axis. At points above the axis, such as e_1 and i_1, the voltage and current are in one direction in the circuit, while at points below the axis, such as e_2 and i_2, they are in the opposite direction in the circuit. The distance between points a and b on the voltage wave is equal to the distance between the points c and d on the current wave. This distance is known as the periodic time, or as 360 degrees. During this time the voltage and current go through one complete cycle. The number of cycles in one second is called the frequency. If the frequency is 60 cycles, for example, the distance from a to b, or the periodic time, is 1/60 of a second. The distance from a to f, at which point the voltage has its maximum value, is 1/240 of a second, or 90 degrees.

The distance from a to c is known as the phase displacement of the voltage and the current. Time progresses toward the right, so that the current goes through its zero value at c after the voltage goes through its zero value at a. In this case

ALTERNATING CURRENTS.

Problem 51. A single-phase alternating-current generator supplies power to a load requiring 48 kilowatts at 232 volts. The current is 254 amperes. (a) Draw both curves and vectors, representing the current and voltage; (b) What is the angle of phase displacement between the voltage and the current; (c) What is the power-factor of the load; (d) What is the equivalent impedance of the load; (e) What is the equivalent resistance of the load; (f) What is the equivalent reactance of the load?

This problem illustrates the determination of the resistance, reactance and impedance of an alternating-current circuit.

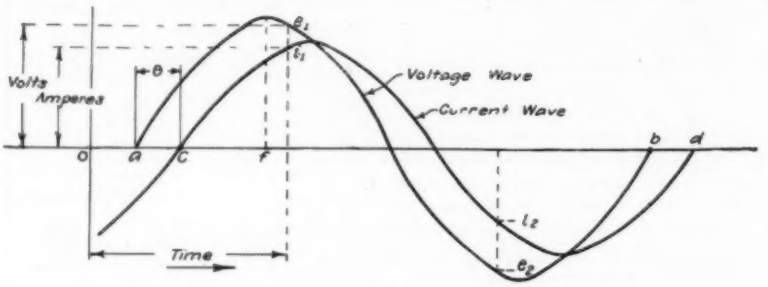


Fig. 1a.

the current is said to lag the voltage by an angle of θ degrees, or the voltage leads the current by the angle θ.

An alternating current is measured by the heat it will develop. One ampere of alternating current produces the same heat in a heating coil as one ampere of direct current. An alternating electromotive force of one volt will produce a current of one ampere when impressed on a heating coil of one ohm resistance. The greatest value of the emf. (at f in Fig. 1a) or of the current is 1.414 times the volt or ampere value.

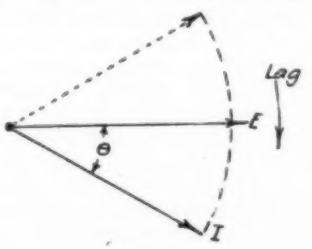


Fig. 2a.

The current and voltage may also be represented by vectors as in Fig. 2a.

If the current lags the voltage, as in this case, it is represented as shown in the figure. If the current had led the voltage it would have occupied the position of the dotted line.

Answer to Question b.

The power in watts consumed by a single-phase load is equal to the product of the *voltage*, the *current* and the *cosine* of the angle of their phase displacement.

[1a] $P=E\ I\ \cos\ \theta.$

In a right triangle the cosine of one of the acute angles is equal to the side nearest the angle divided by the hypotenuse. The sine of the angle is equal to the side opposite divided by the hypotenuse. The values of the sines and cosines for different angles are published in the form of tables.

By equation [1a], $Cos\ \theta=P/E\ I$
$=48000/232\times254$
$=0.815$

θ is the angle of phase displacement between the voltage and the current. From tables:

$$\theta = 35^\circ\ 25'$$

Answer to Question c.

The cosine of the angle of phase displacement between the voltage across a circuit and the current in the circuit is known as the power-factor of the circuit. Or, the power-factor is equal to the ratio of the power in watts to the product of the voltage and current.

[2a] $P\ F$ (power-factor)$=P/E\ I$
$P\ F=48000/232\times254$
$=0.815$

Answer to Question d.

The equivalent impedance (Z) of a single-phase load is equal to the applied pressure divided by the current. It is a positive quantity.

[3a] $Z=E/I$ or $E=I\ Z$
$Z=232/254$
$=0.914$ ohm.

Answer to Question e.

The equivalent resistance (R) of a single-phase load is equal to the power in

DIRECT CURRENTS.

Problem 2.

Two tungsten lamps, L_1 and L_2, are connected to a lighting circuit as shown in Fig. 2.

The resistance of L_1 is 150 ohms and the resistance of L_2, 250 ohms. Each of the conductors connecting the lamps to the service entrance has a resistance of 0.2 ohm. The voltage between the wires at the service entrance is 115 volts and is constant, independent of the current.

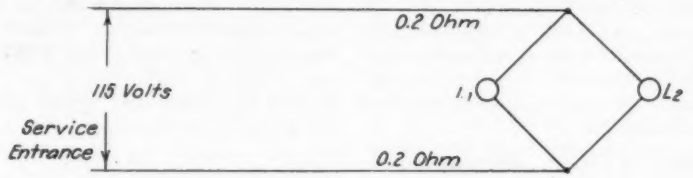


Fig. 2.

Find (*a*) the joint resistance of the two lamps; (*b*) the total resistance of the circuit inside of the service entrance; (*c*) the current in the conductors; (*d*) the voltage at the lamps; (*e*) the current in L_1 and (*f*) the current in L_2.

This problem is given to illustrate the principles involved in a series parallel circuit when none of the parallel branches contains a source of emf.

ALTERNATING CURRENTS.

Problem 52.

A number of small single-phase, 220-volt, 60-cycle motors are jointly delivering 50.2 horsepower at a combined efficiency of 82 per cent and a power-factor of 85 per cent. They are supplied with power from a source about 700 feet away over a circuit of No. 000 conductors which has a total resistance of 0.0936 ohm and an inductance of 0.321 milhenry. The pressure at the source is adjusted so that the motors operate at their rated voltage and frequency. (*a*) What is the total equivalent resistance of the line and the motor load; (*b*) What is the total equivalent reactance of the same; (*c*) What is the total equivalent impedance of the same; (*d*) What is the total voltage drop in the line conductors; (*e*) What is the necessary line pressure at the source; (*f*) What is the power loss in the line conductors; (*g*) What is the power-factor measured at the source of supply?

This problem illustrates the principles of series circuits.

watts divided by the square of the current. It is always a positive quantity.

[4*a*] $R=P/I^2$ or $P=I^2R$

With direct currents the equivalent resistance is also equal to the impressed voltage divided by the current, but with alternating currents it is never equal to the voltage divided by the current except when the power-factor of the load is unity.

By equation [4*a*], $R = 48000/254^2$
$= 0.744$ ohm.

Answer to Question f.

The equivalent reactance (X) of a single-phase load is equal to the square-root of the difference of the squares of the equivalent impedance and the equivalent resistance. When the current lags the voltage, the equivalent reactance is taken as a positive quantity, but if the current leads the voltage it is taken as a negative quantity.

[5*a*] $X=\sqrt{(Z^2-R^2)}$ or $Z=\sqrt{(R^2+X^2)}$

$X=\sqrt{(0.914^2-0.744^2)}$
$=0.530$ ohm.

Unless otherwise stated it is always assumed that the current supplied to a load lags the applied pressure, in which case the reactance is a positive quantity.

The power-factor of a circuit, or the cosine of the phase displacement between the applied pressure and the current, is equal to the ratio of the equivalent resistance to the equivalent impedance. That is:

[6*a*] $P\,F = Cos\,\theta = R/Z$

If θ is the angle of phase displacement between the current and voltage, then the sine of θ is equal to the ratio of the equivalent reactance to the equivalent impedance. That is:

[7*a*] $Sin\,\theta = X/Z$

Small Municipal Plant Advertises.

The Board of Public Affairs of the town of Sabina, O., which owns and operates the municipal electric plant, has found it expedient to resort to advertising, like many private plants, for the purpose of stimulating the consumption of current. The plant is operated in connection with the city's water department, and has been furnishing night service only, but the Board announces that if as many as 35 electric irons are purchased by consumers, current will be furnished for their use for one morning each week. The public is invited to visit the plant, as it is pointed out that it belongs to everybody; and it is suggested that every consumer try to get others to use the service, in order to enable the plant to be operated profitably.

Springfield Rate Controversy.

In connection with the electric rate controversy at Springfield, O., it has been suggested that a municipal plant be constructed, a large element believing that lower rates would be possible with such a plant. The City Commission will probably employ an expert to assist it in determining the rate which the company will be asked to grant. The company is expected shortly to present a full schedule of rates for the approval of the city, with a minimum charge for the service, which is one of the features to which the public generally has expressed the greatest opposition.

Substations Burned.

The substation of the Northern California Power Company at Redding, Cal., was destroyed by fire recently. Nine transformers were burned, entailing a loss of $18,000.

The destruction of the Lowellville substation of the Mahoning & Shenango Railway & Light Company, operating in and around Youngstown, O., resulted from a violent electric storm in that vicinity last week. The station was struck by lightning at the height of the storm, and burnt to the ground, three rotary converters and other equipment being destroyed. Service was interrupted for a time, but was soon resumed, the lines being connected up rapidly to the company's other stations. Lightning also broke the high-tension lines at several places, interrupting the company's lighting and car service.

New England Section of the National Electric Light Association.

Sixth Annual Convention at Narragansett Pier, R. I., September 2, 3 and 4.

The sixth annual convention of the New England Section, National Electric Light Association, was held last week under favorable auspices at Narragansett Pier, R. I. More than 400 members and guests were in attendance, and the sessions were of great interest.

The convention opened Wednesday evening with a reception by the officers of the Section. A smoker for the men and their guests, and dancing at the Casino, filled up the evening.

Technical and business sessions began on Thursday morning, with greetings by Lieut.-Gov. R. B. Burchard, of Rhode Island. He recalled his early wonder at the first view of Edison's carbon-filament lamps and said that Jules Verne's prophecy of submarine transit had become realized. On motion of H. T. Sands, a vote of thanks was extended to the Lieutenant-Governor.

Letters were read from H. H. Scott, president of the National Association, and from J. E. Davidson, Portland, Ore., a former president of the Section, expressing regrets at not being able to attend.

The financial report was read by the treasurer, R. W. Rollins, of Worcester. This showed a substantial cash balance. The report of the secretary, Miss O. A. Bursiel, was read by A. F. Townsend, of Woonsocket, R. I. Attention was called to the publications on file at headquarters, and to the value of the new handbook on Overhead Line Construction.

The report made mention that three members had died during the year: R. B. Hampson, C. F. Prichard and L. S. Risley. A gain in membership of 86 has been made since January 1. The list stands as follows: Class A, 120; B, 533; C, 14; D, 54; E, 176; total, 897. The membership by states is: Maine, 26; New Hampshire, 34; Vermont, 44; Massachusetts, 438; Rhode Island, 86; Connecticut, 111; Boston Edison Section, 150.

A change has been made in the constitution, by which members may join the Commercial Section or any company section without added dues.

A plan was advanced by the secretary with the endorsement of the Executive Committee for lectures to be given by Miss Bursiel before Women's Clubs and other organizations with the aim of informing women of the uses of electrical devices. Central stations wishing to avail themselves of this service may furnish a demonstrator if desired.

A. F. Townsend being called to the chair, President C. C. Wells then made his address. He called attention to the new plan of having each member's name inscribed on his badge, for the better introduction of members to one another. He referred to the recent Philadelphia convention as the most remarkable ever held in the industry. Miss Bursiel's work as secretary came in for the usual words of commendation, and her plan for lecture service was endorsed.

Relation of Meter Maintenance to Revenue.

The first paper of the morning was on "The Relation of Meter Maintenance to Revenue," by G. F. Atwater, of the United Electric Light & Water Company, New Britain, Conn. Mr. Atwater called attention to the factors which cause the lagging of meters, such as worn or cracked bearings, dust, loose adjustments, bent disks and short-circuited coils, resulting in a loss of revenue to the central station. While other conditions—weakened magnets, loose adjustments and short-circuited coils—may speed up a meter, thereby increasing the lighting company's revenue, it is found by experience that a much larger percentage of meters are retarded than accelerated.

The importance of as high a percentage of accuracy as possible is taken for granted. Since meters operate differently under varying loads, it is difficult to determine the actual amount of energy used by the customer. It can be approximated by obtaining the average percentage of accuracy of a meter operating under a variable load, which can be come at as follows. Multiply the result of the test at normal load by three and add to this the result of the test at one-tenth capacity and full capacity of the meter and divide the result by five. The quotient will be the average percentage of accuracy. The normal load is generally taken for residences as 25 per cent of the total installation, and for general store lighting 60 per cent of the total installation.

Since meters run more accurately on full load than on a light load, companies should have meters installed which will be of such a size as to be nearly fully loaded when operating normally; that is, the capacity of the meter should be between 25 and 100 per cent of the capacity of the installation. Meters are now built to stand 200 to 300 per cent overload; hence a considerable overload may be put upon them temporarily without danger of burning out. This does not apply, however, to motor loads, nor should any meter be subject to long continued overload, as poor efficiency is realized.

Mr. Atwater held that many installations, particularly in the smaller cities, have too large meters—10-ampere meters where 5-ampere meters would give better rsults.

All meters should be tested periodically, those of earlier types more often than the newer ones. Where meters are located close together, a test every eighteen months is not too often. Where the installations are more scattered, as in the case of the smaller companies, tests should be made less often, as the expense is greater per unit, and may not be justified by the gains.

It was shown that the maintaining of the accuracy of station voltmeters bears a close relation to revenue. A station voltmeter reading one per cent high means a loss of 1.5 per cent in revenue to the station and 3.5 per cent loss in light to customers. Thus it is important to maintain the voltage as high as possible, with due regard to the life of the lamps. This cannot be done unless the station voltmeters are frequently calibrated and tests taken ot the voltages in various localities. The importance of careful and competent men in making readings and meter tests was pointed out. Though the cost of such labor may be slightly more, the results amply compensate for the added outlay.

The discussion was opened by C. F. Taylor, of the Boston Edison Company, who held that every new meter should be tested before installing, with respect to its mechanical construction and to see that its calibration has not been changed in transit. Since direct-current meters are much affected by external magnetic fields, a test is desirable two or three weeks after installation.

C. A. Dean, of Cambridge, Mass., said that about 70 per cent of the Cambridge company's meters are of five ampere capacity. The units of older types often run fast, and on complaint and test it is sometimes necessary to make an allowance to a customer.

H. W. Brown, of the General Electric Company, viewed the taking of three tests as a waste, the light and full-load tests being sufficient. All meters are liable to drift, and reliance must be had on the meter, which should be of the most improved type.

F. B. Hall, of Providence, R. I., pointed out that short-circuits are the

chief cause of inaccuracy. Vibration of the wall on which a meter is installed will often make a meter creep. This company's meters are tested on a 10 and 100-per cent load; with these extremes the "normal" load test is superfluous. Mr. Hall upheld the contention that meters should not be of too large capacity. He set the average cost of testing direct-current meters at 40 cents each, and of alternating-current meters at 35 cents. All meters of the Providence company are tested at least yearly, those in department-store installations being tested once every two weeks. Of 10,866 tests, an average accuracy of 99.5 was found, the loss of 0.5 per cent in revenue meaning $2,500 for a year.

W. J. Mobray, of Providence, believed the matter of accuracy to be one of fairness to the customer and hence the cost of making tests had little bearing on the subject.

F. W. Prince, of Hartford, Conn., said the Hartford Electric Light Company tests every meter received from the factory, and also when a meter is taken in from a service that has been discontinued. Induction meters in service are tested every 2.5 years and commutator-type units in residential use, once in nine months. Large light and power meters are tested every fortnight. The three-test method outlined in the paper is employed. This is recommended by public service commissions in the Eastern States. Meter maintenance is for the purpose of meter accuracy and correctness in bills, this being necessary to satisfy the customers. Incorrect bills, on the other hand, may mean complaints to the state commission. A company's testing department should correspond in method and equipment with those employed by the supervising body. The Hartford Company's instruments are interchangeable with those used by the Connecticut Public Service Commission.

Street Lighting Versus Cooking Rates.

"Rates for Street Lighting and Rates for Cooking," was the subject of a paper by R. S. Hale, of the Edison Electric Illuminating Company, of Boston. Mr. Hale divided the subject into three heads: (1) How much shall be charged in all for any given service? (2) How shall the charges be made? (3) What shall be charged in each case?

The gross income of any company must cover material, labor and capital charges, at fair margins of profit to all concerned. The question of total charges for all service should be kept distinct from that of relative prices. The system of charging for street lighting in New England has generally come to be a rate per lamp. Contracts usually specify the type and size of lamp and do not contemplate any change in these during the life of the contract. The number of lamps, however, may be increased. Mr. Hale recommended for companies supplying only one municipality on a settled schedule of hours a price per lamp; while for companies that wish to give their towns or cities the option of changing their schedule of hours without dickering for a new price, the Boston Company's system is good—a fixed price per lamp plus a running charge per lamp-hour.

Methods of selling current for cooking and heating are either a fixed sum per month for a range or heater; a price per kilowatt-hour, or a combination of these two. The fixed charge is objectionable, in that it allows waste. The rate per kilowatt-hour should decrease with increasing quantity consumed. Besides a rate per kilowatt-hour, it is possible to have another charge depending on the maximum demand or connected load, or by making the kilowatt-hour price depend on the kilowatts of demand. The charge based on maximum demand, however, is liable to scare away business having a high demand.

Mr. Hale believed the future of the cooking and heating business lies in the large units that will do the work quickly and remain on only a short time. In such cases a charge based on the demand will discourage business, and is undesirable. The best rate, then, is one based on kilowatt-hours, with wholesale blocks. The first block should be the same as the lighting rate, so as to prevent a customer who wants only a kilowatt-hour per month from asking for this rate. The first 10 or 20 kilowatt-hours may be at the lighting rate, with the balance at lower rates.

The actual figure for this service must depend, in the last analysis, on "what the traffic will bear." The competition in costs of coal and gas must be met, the test being that the total of all the rates for this class of service must give a fair profit, but only a fair profit.

The point was brought out that discrimination between classes of service results in lower prices to all classes than if a fixed rate were applied to everyone alike. If customers of several classes can pay the same rates they should do so, but where they are unable to pay equal rates for the varying services they should pay what they are able to pay, so long as there is profit in the business.

The cuts in rates should be made in those classes of service in which there is latent business that can be obtained through cheap service. The point at which a rate is as low as it ought to be, can be found only by experimenting.

In Boston the reduction in the rates for commercial and house lighting from 62.5 cents per 1,000 candlepower-hours, to 20 cents, brought an immense increase in business. The cut in street lighting from $300 for about 400 candlepower to $103 for 1,100 candlepower has hardly increased street-lighting income, at any rate, not in proportion. When reduction in price for some class of service is warranted, it is often difficult to decide which class is most entitled to the cut. The public should see, however, that which ever class receives the benefit, the community as a whole is so much the gainer. Every cut in street lighting, postpones lower house rates, but as a rule a city council can bring more pressure to bear to bring about a lower street-lighting rate than scattered lighting customers can do to effect a lower commercial and residential schedule.

J. E. Gray of Providence, in opening the discussion, said that high prices of electric ranges militate against the general adoption of electricity for cooking. The central station should insure its proper return from the outlay necessitated by ranges—the added transformer and other connections required. The rate should be such as to encourage the use of ranges with the smaller demand such as are now being brought out. The Narragansett Company charges $2.00 per month for demand up to 4 kilowatts; over that, $1.00 additional per added kilowatt. Current is charged at 2 cents per kilowatt-hour regardless of the amount used. The contract for range supply runs for one year, with the proviso that if the service is discontinued meanwhile, the customer shall pay for removing the transformer and connections.

A. E. Hibner, of Portland, Me., said that the rate should be low enough to get business and high enough to pay interest on investment. The value of service in relation to rate-making is out of date. Why discriminate between classes of service? Rates should be based on investment and production costs. A high street lighting rate, compared with a low cooking rate, is liable to result in the demand for a municipal plant.

A. J. Campbell, of Waterbury, Conn., said that courts and commissions are coming to recognize as legitimate a discrimination in rates for various classes of service. Low prices for cooking are not justified on a cost basis. A power rate of 7.5 cents per kilowatt-hour bears as large a per cent of cost as a 10-cent rate for cooking. Referring to the danger of making too low a rate for cooking, Mr. Campbell pointed out that with 3 cents as the equivalent of a prevailing gas rate, there may be a new condition arising in gas manufacture which will warrant a 4-cent electric rate; central stations then may find it difficult to raise the

price. Loss to the company may thereby result. Nowadays people will sacrifice cost to avoid delay. The high demand for a short time will be the future of the cooking business. If the diversity-factor is not large, a central station is not justified in making a low cooking rate. He held, from examination of gas-cooking records, that cooking shows decided peaks at certain hours, and represents a low diversity-factor. He disagreed with Mr. Hale on maintaining high street-lighting rates. Such are liable to create public clamor, more than high commercial lighting rates.

W. P. Schwabe, of Thompsonville, Conn., held that rates for serving several communities should always be uniform for all for the same service, the street-lighting rate to be based on the number of units used, with lower rates per unit for increasing installations.

A. S. McAllister, of New York City, contended that discrimination in rates between classes of service puts an argument in the hands of the municipal ownership agitator. He cited Cleveland's experience, where a low rate of commercial service has been brought about under municipal operation because the company offered to sell electricity at a low rate for railway operation.

Old-House Wiring and Special Campaigns.

At the second session, that of Thursday afternoon, a paper was presented by E. C. Kimball, of the Boston Edison Company, on this subject. Mr. Kimball recited the plan and campaign of his company, begun last November, which has resulted in the securing of 918 contracts for wiring houses hitherto unprovided with electrical facilities.

There are about 160,000 unwired houses in Edison territory, in and about Boston. This represented a large potential business, such as every central station has at hand in greater or less proportion. The small householder is always the hardest proposition. Many schemes which aimed to interest this class failed because the latter could not be convinced of the disinterestedness of the company; they balked at paying contractors' prices for installations. Also, they do not like to be bothered with dickering with a half dozen competing contractors who are out for profit. It has been found by the Boston company that in order successfully to induce householders to sign a wiring contract the company must assume a part of the financial burden. Consequently the company set on foot and carried out the comprehensive house-wiring campaign, by which prospective customers were asked if they would be interested in a proposition to wire their house at an original investment of $2.35, and $2.00 a month for six months—a total of $14.35. For this expenditure a customer is given a service to the premises, a service pipe in the overhead districts, a meter board with fuse plugs, and the wiring of one outlet in armored cable, at any location on the first floor, except the ceiling. This proposition was good bait, but of the 918 contracts, only 29 were for the rudimentary equipment offered. Practically all went further and ordered equipment varying in cost from the $14.35 mentioned, up to over $200. The average contract amounted to about $83. The total value of the contracts was $75,800, representing 17,000 fifty-watt equivalents added to the company's connected load, with an estimated income of $21,000 yearly. Cash payments amounted to $7,700, leaving $68,100 to be paid in monthly installments, which on August 1 amounted to $4,485 per month. Thus the company's financing investment will be taken care of in 15 months and its real investment will be but the interest on $68,000 for about 7.5 months. The net increase in income of $21,000 represents an expenditure on the company's part of only about $2,100.

The company contracts to make the installations without even seeing the premises. The customer simply tells where he wants the outlets, the agent checks them from the published list and totals the results. Then the contract is turned over to a contractor without his having viewed the premises. At first there was some opposition on the part of contractors. They felt that the Edison Company would profit at their expense. In making up the price list the company consulted one contractor, who consented to execute any contract obtained at prices quoted. Then the proposition was put before the contractors as a whole, at a meeting at which all were told that they would all share in executing the contracts if they cared to. The result has been that now 200 contractors are executing the contracts as they are turned over to them, and the company is asked daily if there are not contracts on which they can work.

Wiring contractors are paid $2.00 for each new customer secured, plus 25 cents for each outlet the customer contracts for. In this way 248 contracts have been gotten from contractors for which a compensation of $1,265.25 has been paid, or $5.10 per house. This compensation has been shared by 50 contractors, who are really advance agents for the central station.

Another campaign, began last December, is one by which the company furnishes fixtures for a minimum of 100 watts for interior lighting or 150 watts outside. The inside fixture is a spun-brass canopy with stem and chain, fitted with Holophane prismatic reflector. The outside fixture is a spun-copper inclosed unit with 14-inch glassware that makes it possible to use a 500-watt lamp. In addition to furnishing the fixtures, the company finances the wiring and has adopted the following schedule: 5 outlets, $17.50; 4 outlets, $15.50; 3 outlets, $13.50; additional outlets over five, $2.50 each. Since the beginning of this campaign, 946 contracts have been signed, totaling 13,993 50-watt equivalents and giving a gross income of about $50,000. The contract price is $20,500, of which $3,100 was paid down, with monthly payments of about $1,800. Many fixtures have been installed in places where customers were using little electricity before. Outside fixtures installed up to August 1 numbered 1,027, while interior fixtures installed numbered 8,771.

The house-wiring campaign contemplates the canvassing of only one town at a time, by a squad of special solicitors. When one community has been thoroughly canvassed, the squad takes up work in the next town; by the time the second town is worked, the prospects not already cleaned up in the first town shall be taken care of by the district agent. The campaign is to be continued by the Edison company.

Louis D. Gibbs, of the Boston Edison Company, outlined the residence-service campaign that has been prepared by the Commercial Section of the National Association, and described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN June 20.

J. M. Wakeman, of the Society for Electrical Development, advocated the adoption of the campaign, saying that a project of his society for the issuing of a like campaign has been laid aside because it would be but a duplication of effort, owing to the complete character of the campaign under discussion.

C. H. Stevens, of Lynn, Mass., speaking from the standpoint of a combination gas and electric company, said that in conducting a house-wiring campaign a salesman should have some definite proposition to make. The old method of back and fill, with the contractors as a second party in the offers, is clumsy and nonproductive. He held the plan outlined in the paper of Mr. Kimball to be worthy of consideration by every central station.

J. E. Spike, of Cambridge, Mass., told what the Cambridge Electric Light Company has done. Contractors were unwilling to come in on a plan similar to the Boston Edison Company's. They wanted a minimum contract of $63 for ten lights. Finally a contractor was found who would install the house wiring and connections, with fixtures, glassware, etc., for a ten-light installation

consisting of one 3-lamp chandelier, one 2-lamp chandelier, a cellar light and 4 other lamps, at $42.50. The campaign for new business was started March 9, 1914, with circulars inclosing return postcards. Next, 25,000 printed circulars were issued. Ninety-five contracts were secured in the first five months, amounting to $6,070. Already, 78 of these contracts have been executed. The total value has been $6,800, owing to additions made to original plans. Most of the new business has been from new extensions. The contractors are being won over. Several are now sharing the contracts. The company pays a contractor $3.25 for each new contract secured.

Edward Mandeville, of Worcester, Mass., stated that the Worcester Electric Light Company has conducted a campaign resulting in replacing 2,000 gas installations. September 1 it started a campaign to secure fruit and small-grocery-store business. The plan is to wire the stores rented for the above purpose free of charge, furnish lamps and shades at a rental charge of 10 cents per lamp per month. The contract for the installation is let to the lowest bidder.

R. M. Buttner, of Worcester, told how the contest between contractors and the central station came to be settled. At the initiation of the scheme of house-wiring on lighting-company contract the contractors met and decided not to do wiring for the company. A get-together meeting was held and an understanding arrived at. In the past year 500 old houses have been wired in the Worcester territory, a total installation of 7,826 50-watt equivalents, representing an income of about $7,500 a year.

Company solicitors make a canvass for contracts, and secure a deposit of 25 per cent of the value. A schedule of the work is drawn up and posted without the name of the householder appearing. On these the contractors bid, and the contract is awarded to the lowest bidder. Before acceptance by the customer, the company's inspectors go over the work. If approved the company pays the contractor his bill. Payment to the company by the householder may be in 12 monthly installments.

W. K. Bradbury, of Franklin, Mass., said his company wired a six-room house for $32.50, furnishing all apparatus except the lamps. Lately the proposition has been changed to include fixtures, tungsten lamps and a plug in the kitchen for a flat iron. For $48.75 shower fixtures, an added hall lamp, and a cellar lamp are included. The company is getting about 20 new contracts a month under this plan.

H. G. Pettingell, Jr., of Woonsocket, R. I., stated that in his territory only 11.25 per cent of all the houses are using electricity.

A. E. Hibner, of Portland, Me., said the Cumberland County Power & Light Company is about to enter upon a house-wiring campaign; also an electric-sign campaign, erecting, wiring and maintaining a sign and allowing payments covering three years.

B. H. Gardner disapproved of the policy of giving fixtures free, on the ground that customers do not make as full use of them as they would if purchased.

Mr. Schwabe held that any and every campaign helps the company, in that it keeps central-station activities before the attention of the public. The company he represents wires any installation for $2.50 per outlet. Fixtures for eight outlets are sold at $13.85, which, added to the wiring charge of $20, makes a total cost of $33.85 for an ordinary house with eight outlets. Getting tenement-house business is usually difficult. Their solicitors ask tenants if they would pay 50 cents per month more if their tenements were fitted for electricity. If so, which is frequently the case, the company's agent places the proposition before the owner, who usually accepts. The terms of deferred payment are 10 per cent cash, the balance in twelve monthly payments.

G. H. Allen, of Hartford, Conn., told of a campaign in that city. At first contractors were opposed, but they have become reconciled. The price at which the work is done ranges from $2.25 to $3.35 per outlet. The company accepts contracts for six outlets for $35 and sublets the work of installation for $21, and furnishes fixtures.

A further delineation of new-business-getting methods was made in the report of the Merchandising and Advertising Committee of the Commercial Section, by L. D. Gibbs. The report also suggested methods of handling help, advertising, and selling campaigns.

R. N. Lee, of the Society for Electrical Development, praised the report as being very complete. He believed show windows should have 25 per cent. of a company's advertising appropriation. He held that the plan for central stations to pay contractors a certain per cent over cost the best one, and makes contractors boosters for the lighting company.

A. P. Maynard, of Boston, dwelt on the relation of selling departments to customers, and called attention to the new Electrical Kitchen in the Dexter Building, Boston.

E. R. Davenport, of Providence, R. I., was in full accord with the published report. He would sell socket devices, together with incandescent lamps, at list prices. Central stations should run their electric salesroom separate from the rest of the plant and make it pay. He called attention to the great value of window displays, citing the Hy-lo lamp theater as an instance. Portable lamps should be pushed all the year. With about 12,000 residential customers the company has 6,000 flat-irons connected.

Report of Electric Vehicle Committee.

At the Burlington convention of the Section a year ago it was resolved that the chairman appoint a committee to endorse the electric vehicle to the people of New England and to devise methods to build up the load from that source. The committee was made up as follows: W. H. Atkins, W. S. Wyman, H. B. Ivers, J. Brodie Smith, Ralph D. Parker, F. H. Parker, Wilfred Smith, J. A. Hunnewell, H. T. Sands, W. H. Snow, E. S. Mansfield, A. B. Lisle, A. F. Townsend, A. J. Campbell, C. A. Paul. Mr. Atkins was made chairman and Mr. Mansfield secretary.

The committee sent to each New England central station a list of questions designed to test their interest in electric vehicles and their willingness to become active in the furtherance of the business.

Sixty-seven companies responded: Maine, 10; New Hampshire, 5; Vermont, 9; Massachusetts, 27; Rhode Island, 3, and Connecticut, 13. Of the 67 companies 31 are using 78 passenger and 179 commercial electrics in their business, while 36 do not use any. In the territories covered by the responses 757 passenger and 341 commercial electrics are in use, aside from those in central-station service. Of the 67 companies, 19 have a department or a representative to follow up electric-vehicle business; 48 have none; 28 companies co-operate with electric-vehicle agents in selling or advertising the business. Garages or charging stations are maintained by 33 companies, and 20 companies are members of the Electric Vehicle Association of America. Reasons for lack of interest in electrics are given as follows: impractical, no agency in town, section too hilly, no demand, not interested, town not large enough, not so good as gasoline, waiting for development, no one interested, unsatisfactory for territory.

Seventeen not already using them said they were willing to acquire at least one, 14 would not, and 6 refused to answer.

The replies showed that a few companies in New England are actively interested, appreciate the possibility or are co-operating in the promotion of the electric. Others show half-hearted interest.

Of the 236 electrics in use by the companies, 10 use 66 per cent and one

company 34 per cent of the whole number.

The committee recommends that every central station in New England study the latest developments in electrical vehicles and adopt at least a friendly attitude toward their recognized economical and efficient mode of transportation, which at the same time is the source of increasing revenue to the stations, owing to the off-peak character of the charging load. Each station should own at least one such vehicle for its own use, and as an earnest of its faith in the business. Every company is recommended to join the Electric Vehicle Association of America, equip its power station with charging facilities, and have a trained attendant in charge. The committee holds that the business would be greatly facilitated by the reduction in the price of storage-battery vehicles. The project to form a co-operative company of central-station men to manufacture a low-priced electric car was laid upon the table.

The committee finally pointed out that if 300 New England stations should each buy an electric or cause one to be sold to a consumer, assuming that each vehicle will consume 15 kilowatt-hours a day, the total of 2,700,000 kilowatt-hours, at 5 cents per kilowatt-hour, would represent an income of $135,000 yearly.

The committee report, of which the above is a summary, was presented by Edward S. Mansfield, of the Boston Edison Company.

Frank J. Stone, of Boston, led the discussion, with an interesting compilation of statistics. He said the parcel-post service opens great possibilities for the electric vehicle, this, together with department-store delivery, which is characterized by frequent stops, giving best conditions for its use. A station can reckon yearly income at $105 to $333 per vehicle, on a three-cent rate. Mr. Stone pointed out that the motor-vehicle load differs from the power load in that the former can go anywhere to find its energy supply.

R. P. Daggett, of Boston, representing the Commercial Truck Company, took issue with the report's suggestion that first cost of vehicles should be lower. He maintained that the cost of the motor, tires and other accessories is fixed; hence the reduction would fall on the chassis alone. The price of a two-ton chassis is about $2,800. Reckoning depreciation at 10 per cent and interest at 6 per cent (with successive reductions in principal charge, averaging 3 per cent), the maintenance cost on the chassis would be $364 per annum, or $1.16 per day. A reduction of 33 per cent in the cost price of the chassis would mean only 40 cents per day. The cost of current for charging a vehicle of this size, together with upkeep and driver's wages, averages about $9.00 a day; hence the 33 per cent saving on chassis would represent but 4.4 per cent of the total expenditure; a matter of small significance as compared with other factors.

W. H. Bolewin, of Springfield, Mass., said the United Electric Light Company of that city now has in service 2 five-ton, 3 two-ton, 4 one-ton, and 7 1,000-pound electric trucks, which, together with garaging facilities, represent an investment of about $150,000. The company has done much to promote sales in the territory, but found a lack of co-operation by manufacturers and agents.

W. B. Kirk, of Lynn, Mass., held that the cost of electrics is excessive as compared with gasoline vehicles. A conspicuous merit of the electric is that it does not require so careful a driver as the gas car.

Louis D. Gibbs spoke cogently on the electric vehicle as the central station's opportunity. "The electric has come to stay," he said. "Get in at the start, and stay in." He believed manufacturers were going to keep on selling cars until central stations are compelled to give the requisite service. The electric-vehicle service is one added means by which the central station will satisfy the demands of the public.

W. H. Blood, of Boston, the first president of the Electric Vehicle Association of America, pointed out that the electric and the gas car each has its particular field. He looked forward to the day when lighting companies would awaken to their opportunity of adding to their income through off-peak charging. The engineering firm of Stone & Webster, Boston, has every district manager and most local managers of their properties in favor of electrics and using them.

F. Nelson Carle, of New York, noted that the United States was divided into various zones of interest and of efficiency as related to the electric vehicle. A promising feature is the fact that larger users of electrics are constantly adding to their fleets. The man with one car only is the one who fails to get its best efficiency. Mr. Carle pointed out the need of patient effort on the part of central stations, which, he said, could not hope to reap the full benefits upon catering to storage-battery vehicles the first year.

Day Baker, of the General Vehicle Company, Boston, said he never urged central stations to reduce their charging rates; they usually met the requirements of the situation in a liberal spirit. He named the Boston Edison Company, the Springfield, Lowell, Providence, and other companies as giving advantageous rates. Salem, Worcester, New Bedford, Hartford and Brockton all have fine garages. The Hartford Electric Light Company sells mileage; i.e., charging, care, and garaging, to owners on a mileage basis. A government report to commandants of navy yards advocated the use of electrics. The Fore River Shipbuilding Company, the American Express Company and the New Haven Railroad all have large fleets of electric trucks. The latter claims to save $20 per day per truck in freight handling. The Pureoxia Company, Boston, uses six trucks, and finds its delivery costs lower than with gas cars or horses. Other large users are the Amoskeag Company, Manchester, N. H., sugar refineries in Boston and the Pacific Mills, Lawrence, Mass. The latter company's use of electrics for short hauls is very economical.

H. H. Skinner, of Providence, said that the Narragansett Electric Light Company gave one agent free charging service for his demonstration car. In the past month 8 trucks have been bought by Providence concerns. One department store employs 8 vehicles, the current for which the company supplies at the low price of 8 mills per kilowatt-hour for off-peak charging. Mr. Skinner believed cheaper 750-pound and 1,000-pound delivery trucks would greatly promote the business.

W. M. Thayer, of Hartford, Conn., said the Hartford Electric Light Company owns batteries and rents them to truck users. In July, 1913, there were 38 such cars in operation; in January, 1914, 46; in July, 1914, 54; now there are 57. In the month of August these cars ran a total of 42,359 miles. Two trucks in express service ran 2,776 miles during the month.

D. W. Beaman, of New Bedford, Mass., described central-station practice in that city. He reckoned the income due to the average electric vehicle at $2.94 per month.

G. W. Holden, of the Edison Storage Battery Company, held that the central stations of Northern New England would do well to prepare the ground for the salesmen's visits.

Election of Officers.

At the session of Friday morning, the following officers for the ensuing year were elected: president, L. D. Gibbs, Boston; vice-president, W. S. Wyman, Augusta, Me.; treasurer, R. W. Rollins, Worcester, Mass; secretary, Miss O. A. Bursiel, Boston; executive committee, C. A. Mixer, Rumford Falls, Me.; R. D. Smith, Keene, N. H.; W. H. Vorce, St. Albans, Vt.; E. P. Rowell, Plymouth, Mass.; E. A. Barrows, Providence, R. I.; B. H. Gardner, Waterbury, Conn.

The Grounding of Secondaries.

The technical discussion pertained to the new Code rule governing the grounding of secondaries, and was in charge of H. T. Sands, Boston. W. H.

Blood, insurance expert of the National Association, pointed out that according to the Code, secondary circuits must be grounded if carrying voltages up to 250 volts. Failure to ground produces a life hazard. There are three parties concerned: the public, the waterworks people, and the company. First, the public should be able to use their electric lighting facilities without personal risk. From the company standpoint, both considerations of humanity and of monetary insurance demand that the Code rule be complied with. The liability of $5,000 or $10,000 for a life will pay for many grounds. The waterworks authorities are coming to realize that grounding is a means of protection to life. Early trouble from electrolysis was usually due to improperly grounded return wires of street-railway companies. Electric light companies, Mr. Blood said, have as much right to the use of the ground for their purposes as have the waterworks people. Companies should convince water boards and companies that grounding on water pipes is necessary. Fire underwriters, who more than anyone else are interested in the integrity of water systems, say that grounding is imperative.

Larger cities in which companies are grounding their secondary circuits on water pipes are: Chicago, Baltimore, Brooklyn, New York, Boston and Toronto.

Commissioner of Wires Cole, of Boston, has required grounding on water pipes for ten years.

The Public Utilities Commission of New Jersey two years ago ordered the grounding of secondaries up to 250 volts, either to water mains or continuous ground wires. Though the National Electrical Code is not retractive, Mr. Blood said that existing services should gradually be connected as required. The Code offers as a substitute for water pipes a copper plate buried in "permanently moist soil." Driven pipes or cones are not allowed. As between the customer's service and the main, the former is preferable. The proper way to make connection is with a brass plug in the pipe, with wire soldered to this.

Mr. Blood pointed out the danger of the court holding a company criminally negligent if the prescribed rule is not complied with and fatality results.

M. G. Haight, of Worcester, Mass., said that the Worcester company has grounded the neutrals of its three-wire secondary circuits. This is done underground, to avoid electrolysis.

Mr. Dean, of Cambridge, Mass., said that six years ago letters were sent to customers asking permission to ground on water service pipes. Of 2,000 letters sent, 300 replies granted permission. A contractor was employed who did the work for about $10 for each installation. This outlay the company bore, but on new work the customer is required to pay the expense. Gradually the grounding of all services has been brought about, the city electric department helping.

A. D. Colvin, of Hartford, Conn., and C. A. Mixer, of Rumford Falls, Me., recognized the necessity of the Code provision.

W. T. Oviatt, of Providence, stated that grounding as required has been carried out thoroughly by the Narragansett Company, and described contract requirements on new work. No accident or trouble has occurred in ten years from this source. No fuses are used on ground wires.

Alexander Macomber, of the Tenney Company, Boston, said no one could doubt the necessity of grounding to water system, best accomplished by a brass-plug attachment. Municipal waterworks must aid by the necessary permission. The best has to be considered. He said it costs $25 to $30 to ground at the transformers for services taken from it.

W. S. Wyman, of Augusta, Me., said the Central Maine Power Company has been carrying out the new rule. He suggested the desirability of taking up the subject with the New England Waterworks Association, to secure their co-operation.

P. F. Hodgkins, of Woonsocket, said his company now requires all new installations to be grounded on the service side of the water meter.

Mr. Bolewin, of Springfield, said the Water Board of that city demand $1.00 for each connection; hence the work is in abeyance.

A. E. Burland, of Boston, said that in Rochester, N. Y., every service is grounded separately, and the driven-pipe system has been discarded as worthless.

Mr. Beaman, of New Bedford, stated that a city ordinance requires grounding to both water and gas pipes.

Mr. Sweetland, of the New England Insurance Exchange, said insurance regulations required either perfect insulation or else grounding. From data gathered during the 14 years since the matter came under consideration, in 99 cases of every 100 grounding will prevent trouble between primary and secondary circuits. Grounding on the service side of water meters is the only way. The cost should be considered a part of a company's liability fund. In cases of loss of life through neglect, courts are likely to hold a company criminally liable. Regarding the use of plates in "permanently moist soil," the Edison Company of Boston drove a pipe 40 feet deep in one instance without getting satisfactory grounding. This method was abandoned, and now all grounds are on water pipes.

Mr. Blood said that a committee of the National Association will have a conference with the Waterworks Association. His final appeal for the carrying out of the Code requirement was based on grounds of humanity.

Alexander Macomber pointed out the need of a periodic filtration of transformer oil, and also that of oil switches.

C. A. Mixer said not only filtering but drying the oil is necessary on high-voltage circuits.

Mr. Willis, of the Lowell Electric Light Corporation, said the presence of water in transformers is of frequent occurrence, and is remedied by filtering through sand.

W. T. Oviatt, on the subject of high voltage and secondary circuits, carried on the same poles, said the Narragansett Company carries 11,000-volt and 2,300-volt wires on the same poles; in some cases telephone wires are also carried. The desirability of as wide spacing as possible is recognized. Insulators of the best type only should be used. On the company's 33,000-volt transmission line, not an insulator has failed in the year's operation.

J. W. Cowles, of the Boston Edison Company, said that company operates 13,000 and 2,300-volt lines on the same poles, with a six-foot spacing. On crossings over railroads and telegraph lines a net was formerly used, but now grounded pins and crossarms with ground plates are employed; but the company is making a practice of putting its high-voltage lines underground.

Banquet.

The convention closed with a banquet on Friday evening. President Wells presided, and there were speeches by T. Commerford Martin, secretary of the National Association, and L. D. Gibbs, the newly elected president of the Section.

Mr. Martin referred to the growth in membership. There are now 13,500 members of the National Association. He discussed association policies, the merits of the "Salesman's Handbook" and the "Handbook on Overhead Line Construction," issued this year at a cost of $12,000.

Mr. Martin took an optimistic view of the outlook for electric lighting companies at the present period of unsettled conditions in the world. He pointed out their large diversity-factor, which makes for the stability of central-station business. The possibilities of the foreign field for marketing American electrical manufactures were pointed out.

Mr. Gibbs spoke on "The Modern Newspaper" and its relation to the electrical industry.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION.

Annual Convention Held at Glenwood Springs, September 3-5.

A very marked advancement of Colorado electrical interests will probably be the result of the annual convention of the Colorado Electric Light, Power and Railway Association, held at Glenwood Springs, Colo., September 3, 4 and 5. This association has done excellent work in past years in forwarding the electrical industry of the Mountain States, but the members from now on wish to move faster and to secure better results. To stimulate greater growth it is proposed to open a central office in Denver and employ a paid secretary.

It is felt that a broad policy of this kind vigorously pursued would adequately meet the future requirements of the association and care for the increased business that will come with the activities of the new Public Service Commission. The members of this Commission are now doing their preliminary work of organization, and it is, of course, expected that they will soon have a great deal of business with the various utilities of the state.

W. C. Sterne, the retiring president of the association, expressed himself very enthusiastically about the new plan, but was fearful that the expense would be too great at this time; he recommended that the matter be referred to the executive committee, members of which will pass upon the advisability of the matter in the course of a few weeks. It is hoped that the committee will be able to shape its plans to carry out the proposed change.

Although the program of the convention was not as extensive as usual, it made up in quality what was lacking in quantity; close attention was given the reading of the papers, and the discussions brought out a number of excellent points that will undoubtedly be of the greatest value to the Colorado companies.

It was the unanimous opinion of the members that the National Electric Light Association should be given the most active co-operation in connection with the convention which will be held in San Francisco next year. The association desires to be a factor in the success of that gathering and will do everything in its power to attract a large audience from the Mountain States. Not much is known about the great hydroelectric properties of Colorado, and it is the desire of the association that Colorado be given some attention in this matter. An effort will be made to get the consent of the program committee for a paper dealing with this very interesting subject. Another reason why Colorado is anxious to take a prominent part in the success of the convention is that H. H. Scott, the new president of the National Association, is a former Denver man and gained much of his early success in Colorado.

Now that Colorado is entering upon a public service commission regime, an effort will undoubtedly be made to educate the people with reference to the progress attained in those states where the rulings of public service commissions have been fair and intelligent. It is thought that if the people are thoroughly informed on what has been done in other states they will not be inclined to criticize any ruling of the Colorado Commission that may seem to favor the public service companies. The association is giving some consideration to the matter of having a series of addresses made before the united commercial bodies of Denver, within the next six months. These addresses will be given by men prominent in public service commission work. Such a course of lectures would undoubtedly cause a great deal of publicity and would give the people information that will enable them to understand many of the problems confronting public service companies today.

The entertainment features of the convention provided a lively and enjoyable time, and the ladies in attendance voted the meeting the best ever. Mr. Lucas, the manager of the Colorado Hotel, was more than a genial host, and was always ready to see to the comfort and enjoyment of his electrical guests. He gave them the full run of the famous pool free of charge, and every lady and gentleman at the convention took frequent advantage of this very generous offer. The entertainment portion of the program was concluded with a beefsteak fry several miles up the canyon east of the hotel.

The convention was opened by an address of welcome by Mayor Charles D. Barnes, who extended the electrical men the freedom of the city. He said that the electrical men had been coming to Glenwood for a great many years, and expressed the hope that every electrical man coming from the East to attend the Exposition next year, would stop and take advantage of the many splendid features of the Glenwood resort. The members promised him that they would leave no stone unturned to this end.

Voltage and Revenue.

The subject of the first paper was "Relation Between Incandescent Lamp Voltage and Resulting Revenue and Service," by R. Arnold Lewis, of the General Electric Company. Mr. Lewis said that more consideration should be given to operating incandescent lamps at the voltage marked on the label. He asserted that many companies were losing a great deal of revenue by neglecting to keep up the voltage. For a change of one volt in voltage there results a change of approximately 1.5 per cent in wattage; the change in candlepower, with change in voltage, is more noticeable than the change in wattage. A variation of one volt will produce a change of approximately 3.5 per cent in candlepower. From this it is evident that a drop in voltage will cause considerable impairment in the lighting service supplied to the consumer.

Mr. Lewis stated that incandescent lamps are affected only by the voltage impressed upon them when they are operated. Therefore, an analysis of the voltage conditions should be made during the time that practically all the lamps are in operation, namely the time of maximum lighting load.

In making an investigation of the voltage, he said, proper allowance should be made for the voltage drop between the service cutout and the lamp sockets. By taking a number of readings at both places it will be possible to get the average figure which will represent this drop fairly well. It will be found to approximate two volts under normal conditions. After investigation is made, the problem is to determine the voltage of lamp which will give the best results under the conditions as found. The most consideration should be given, of course, to the readings taken where the bulk of the lamps are used. If the investigation shows that the average voltage is less than the voltage of the lamps which are used, it would be advisable to boost the voltage at the plant until the average voltage at the lamp corresponds to the rated voltage of the lamps used. It is more desirable to boost the voltage and use lamps of the present labeled voltage than it is to order lamps of a lower voltage, since the former will immediately give the central station its proper revenue and the customer proper illumination. In addition to this it will cause an increase in the wattage consumption on practically all of the current-consuming devices on the system. It is assumed, of course, that the change will not be great enough to materially affect the performance of other apparatus.

The three voltage ratings which have been used in the past on most lamps has been superseded by single voltage rating, which is being used on all Mazda lamps. The old rating has been greatly misunderstood, and as a result led to considerable confusion.

The voltage on the new rating corresponds to the top voltage on the old rating, and is the voltage at which the lamps are designed to operate.

The subsequent discussion developed that a number of the member companies had been suffering in the manner indicated by Mr. Lewis and the members present expressed themselves as being glad to learn many things about this question which they didn't understand heretofore. Mr. Dostal brought out the fact that his company was using lamps two volts under voltage. Mr. Lewis said that the central station and the jobbers were not acting in harmony in the lamp-voltage proposition. He called attention to one case where the central station was recommending a lamp three volts higher than the jobber was recommending.

The discussion drifted to comment on lamp matters generally. Some of the member companies reported that they were selling the low-wattage lamps, but the majority of the companies expressed themselves as being against their use. Those who favored the low-wattage lamps were of the opinion that they encouraged more liberal use of lighting which in the end means more revenue for the central station. It was reported, however, that reorders of the small-wattage lamps were not numerous, due, it was thought, to the fact that these lamps are fragile and have necessarily weak illuminating power.

With regard to flat-rate lighting for cabins in mining camps Mr. Hammond said that where there were only three lamps to a home they were giving there a flat rate of 75 cents per month per lamp and fusing the circuit so that a greater demand would cause the fuse to burn out; this kept a check on the use of heating devices on the lamp flat rate.

Industrial Power.

The next paper was on the subject of "Selling Electricity for Industrial Purposes," by Frank D. Burr, power expert of the Denver Gas & Electric Light Company.

Mr. Burr said that every shop and factory is a prospect for industrial power. He pointed out that a thorough canvass should be made and the company representative should get acquainted with managers, superintendents and workmen. Such a course is sure to result in a changeover from steam, oil or gasoline if a proper analysis be made and a report of the net results submitted.

He stated that the application of ice machines for general purposes is not new, but is just as important as ever since it helps to fill the summer valley and tapers off as the winter load comes on. The power cost is one-third the cost of ice when a three-ton machine or larger is used, and the saving in foodstuffs in many cases will pay for the cost of the machine in a year. The buying of materials when the price is low and putting them on the market when the demand has created a rise is one of the important advantages.

Power consumption by dairies and creameries he regarded as offering a good opportunity for excellent revenue. The creameries must use off-peak lighting, ice machines, pasteurizers and pumps; so that they often have a consumption of from 1,000 to 9,000 kilowatt-hours per month, while the dairies not only require midnight lighting for milking, but power for pumping, irrigating, alfalfa grinding, silage cutters, milking machines, which with a two-machine equipment will use a consumption of 120 kilowatt-hours per month, and a new application in the use of electric current for the sterilizing of milk.

Mr. Burr took up the subject of electric pumping for irrigation, which is having a considerable development in Colorado. He said that this is another ideal load for filling the summer valley. Several plants throughout the Western States are operated chiefly for reclamation purposes, and after the crops have been gathered and there is no longer demand for water, the capacity of the plant is sold for atmospheric heating of houses and buildings in order to help pay the fixed charges.

He said that an electric heating load is probably the most important of the new applications. Every shop and factory is a prospect. Since the use has been made of alloys of nickel and chromium for resistance wire, the heating units for domestic and industrial purposes are giving but little trouble. Possible prospects in the industries are in the use of soft-metal pots in machine shops and electric repair shops, for melting babbitt, solder, and, in furniture repair and manufacturing, the melting of glue. Electrical furnaces can be profitably used for heating rivets in structural steel yards and in the erection of steel bridges, viaducts, office buildings, etc., while metallurgical uses of the electric furnace will find more and more chances of consumption. Mr. Burr also explained electro-static separation of iron and zinc and the new methods of concentration using air instead of water, by which a plant may be installed on a mountain peak if supplied with power for grinding, crushing, sizing, and for driving blowers, concentrators, conveyors and bucket elevators.

G. N. Robinson asked if there were any small refrigerating machines that could be satisfactorily used for small domestic purposes. Mr. Burr replied that he had corresponded with manufacturers of two machines which could be run with a 0.25-horsepower motor, and that these would be demonstrated at an early date in the salesroom of the Denver Gas & Electric Light Company. Mr. Clay of Ouray reported that he had made experiments in heating a business house and could hold the business if he would sell current at 0.4 cents per kilowatt-hour. He asked if any member companies were supplying a heating load of this kind, and if so at what price. Mr. Burr replied that the Denver Company supplied a good deal of current at lighting rates for luminous radiators in the fall. He said that these radiators were used to remove the chill from some rooms in residences and thereby postponed the expense of maintaining furnaces until the very cold weather.

Mr. Hammond inquired if any member company had secured refrigerator business from apartment houses. Mr. Burr answered that he had been given some encouragement in this direction from prospective builders of several apartment houses that will be constructed in the near future.

Load Building.

The next paper was on "Industrial Load Building," by J. Solberg, of the Westinghouse Machine Company, Denver. This paper dealt with the important development that has taken place in connection with the arc welding equipment. This process has become a very important factor in all welding that must be done in machine shops, general repair shops, but more particularly the railroad and railway shops throughout the country. It was brought out that electric arc welding is now being successfully used by the Pennsylvania Railroad Company, the New York Central Railroad Company, Baltimore & Ohio Railroad Company, Union Pacific Railroad Company, Southern Pacific Railroad Company, National Brake & Electrical Company, Jones & Laughlin Foundry and Machine Shop, and Nestor Machine Shops, as well as a number of other companies throughout the country wherever wrought iron and steel are being worked.

A number of questions were submitted for the consideration of the members by H. S. Russell of the Denver Gas & Electric Light Company, who has charge of the question box. These questions embraced an extended discussion regarding lines and transformers, wiring, lamps, meters, new-business methods and management. Among the most interesting were those dealing with the commercial side of the business. It was found that most of the companies put out a large number of electrical devices on trial. For instance, the Northern Colorado Pow-

er Company will put out any electrical appliance on trial for a reasonable time. The Denver Company restricts this practice to electric irons, although in some cases they are glad to put out percolators and electric toasters on trial.

One of the questions asked was, if central stations were satisfied with the advertising service furnished by manufacturing companies. All agreed that the various services were excellent and produced good results.

Another question submitted was whether the member companies were pleased with the portable vacuum cleaners now on the market. All reported general satisfaction and that the companies were having good success in placing the cleaners.

All of the companies reported that they were paying a good deal of attention to the safety-first movement; the Denver Tramway Company is making an intensive campaign and, according to Mr. Matthews, their representative, they are securing fine results.

Election of Officers.

The following were elected officers of the association for the ensuing year:

President, W. F. Raber, general manager of the Arkansas Valley Railway, Light & Power Company, Pueblo.

Secretary and Treasurer, Thomas F. Kennedy, sales manager of the Denver Gas & Electric Light Company.

Vice-president, John J. Cooper, Arkansas Valley Electric Company, Brush Light & Power Company, Gilpin County Light, Heat & Power Company.

Executive Committee: W. J. Barker, general manager of the Denver Gas & Electric Light Company; H. U. Wallace, vice-president of the Northern Colorado Power Company; L. P. Hammond, general manager of the Colorado Power Company.

Advisory Committee: H. L. Titus, general manager of the Sterling Consolidated Electric Company; J. F. Dostal, general maanger of the Colorado Springs, Light, Heat & Power Company; H. L. Corbett, general manager of the United Hydro-Electric Company; J. A. Clay, general manager of the Durango Gas & Electric Company; Franklin P. Wood, general manager of the Trinidad Electric Transmission, Railway and Gas Company.

Finance Committee: W. C. Sterne, vice-president and general manager of the Summitt County Power Company; H. L. Woolfenden, Allis-Chalmers Company; W. G. Matthews, Denver City Tramway Company.

Membership Committee: E. L. Siekmann, Westinghouse Company, Denver; C. N. Stannard, Denver Gas & Electric Light Company; R. Arnold Lewis, General Electric Company, Denver.

Consolidation of Utah Utilities Progressing.

Progress is being made in the consolidation of the Utah Power & Light Company and the Utah Light & Railway Company, both with headquarters at Salt Lake City. A meeting of the stockholders of the Salt Lake Light & Traction Company is called for September 15 for the purpose of considering and voting upon a proposition to consolidate this company with the Utah Light & Railway Company. A special meeting of the stockholders of the Utah Light & Railway Company is also called for the same date for the same purpose.

The Salt Lake Light & Traction Company was incorporated early in August of this year with O. J. Salisbury as president. It is understood that this company is backed by the same interests which control the Utah Power & Light Company and that this incorporation was effected for the purpose of consolidating this latter company with the Utah Light & Railway Company.

Another step toward the proposed consolidation was made when the Utah Power & Light Company presented a communication to the Commissioners of Salt Lake City, requesting permission to consolidate the franchise granted to the Merchants Light & Power Company and which it holds by assignment with the Utah Light & Railway Company's franchise. The Merchants Light & Power Company was organized about three years ago for the purpose of entering into competition in Ogden and Salt Lake City with the Utah Light & Railway Company. The franchise and property rights of this company were acquired by the Electric Bond & Share Company about two years ago, when the principal electrical interests outside of Salt Lake City and Ogden in Utah and Southern Idaho were acquired and the Utah Power & Light Company formed to take over these interests. General Manager Paul B. Sawyer, of the latter company, has issued the following statement in connection with the application:

"Interests connected with the Utah Power & Light Company propose to acquire the property, rights and privileges of the Utah Light & Railway Company. The acquisition of the property and rights of the Utah Light & Railway Company is not completed, but is still more or less tentative. The Utah Power & Light Company is now the owner of a light and power franchise from Salt Lake, one of the terms of which is that the grantee shall procure the consent of the Commission to any consolidation, either direct or indirect, of the business and properties of the grantee with that of any other company in Salt Lake.

"We have applied to the Commission for that consent. The franchise itself is a very advantageous one to the city, inasmuch as the right of regulation is reserved by the city. Many advantages to Salt Lake and its inhabitants will result from an economical management and control of the properties."

The City Commission has indicated its willingness to transfer the franchise in accordance with the request, but implies that this will be done only on the condition that a substantial reduction in the rates of electricity for lighting and power services be made in consideration of such transfer. The reply to the company's communication is now being prepared by the city attorney.

Merger of Electric Utilities at York

With a capital stock amounting to $1,301,500, a large corporation is now in process of formation which will care for most of the electrical utilities of the city of York, Pa., and a considerable portion of York County. The new company is to be known as the Edison Light & Power Company. It will include the Edison Light & Power Company; the Merchants' Electric Light, Heat & Power Company; the Lower Windsor Township Light, Heat & Power Company; Spring Grove Light, Heat & Power Company; Jackson Township Light, Heat & Power Company; and Heidelberg Township Light, Heat & Power Company. The last named six companies are now applying for charters. They were organized recently by the Edison company and have secured or are seeking franchises in their districts.

Providing the application for the merger of the companies is granted by the Public Service Commission of the state, the corporation will be managed by the York Railways Company by stock ownership. The first step in the merger proceeding was the granting by the city of its approval of the plan. This was done by ordinance passed on July 3. This ordinance permits the Edison company to acquire the property, assets and franchise of the Merchants' company. Under it the $5,000 bond of that company will be turned over to the city of York. The city will receive three per cent of the gross receipts of the new company, whereas at the present time it only receives that amount of gross receipts of the Merchants' company.

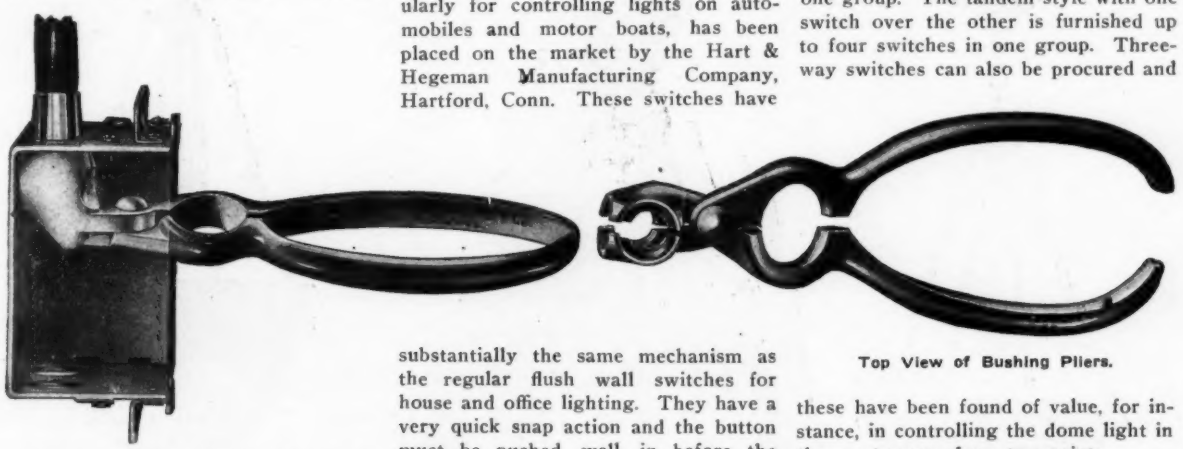
Idaho Falls Municipal Plant Enlarged.

The new 1,000-horsepower generating unit recently installed in the city municipal power plant at Idaho Falls, was put into operation on August 30 and as a test the complete lighting and pumping load for the city was cut in, the unit carrying the load well.

New Electrical and Mechanical Appliances

Universal Bushing Pliers.

The line of Universal bushings made by the New Process Specialty Company, Incorporated, Milwaukee, Wis., has been found of great value for bushing flexible fibrous tubing or conduit into switch and outlet boxes. These bushings, as described in one of our previous issues, are made of spring metal and are so shaped that they can be readily attached in any knockout ordinarily accessible; for such positions the bushings can be inserted with the fingers without requiring any tool.



Pliers for Installing Universal Bushings.

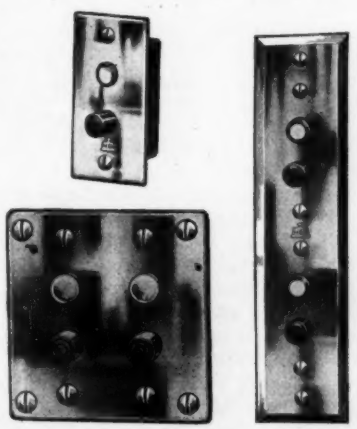
Top View of Bushing Pliers.

In some cases, however, the location is such that the box or knockout in it is difficult of access and for this purpose the company has placed on the market the bushing pliers illustrated in the accompanying views. These pliers can be used in any kind of switch or outlet box and are especially designed for use with the Universal bushings made by the company. They will readily grasp any size of these bushings and hold them firmly in position for insertion or removal. The large grip near the handles is used for installing the larger bushings, that is those intended for seven-eighth-inch knockouts. The head of the tool has two grips; one in the end for installing the bushings into the side of the box; another grip at right angles thereto is arranged for installing the bushings at either top or bottom of the box. The manner in which this is done is shown in the accompanying illustration.

These pliers have been found to greatly facilitate the use of these bushings and since they are made of good material and are yet low in cost they form a valuable tool in the electrician's kit.

Miniature Push-Button Switches.

A line of push-button switches intended for low-voltage work, particularly for controlling lights on automobiles and motor boats, has been placed on the market by the Hart & Hegeman Manufacturing Company, Hartford, Conn. These switches have substantially the same mechanism as the regular flush wall switches for house and office lighting. They have a very quick snap action and the button must be pushed well in before the switch blade is thrown. This prevents throwing on or off of the switches by accidental contact. The blade of the switch has only two positions, the on and off, and it is impossible for the blade to remain in any intermediate point that would cause arcing or fusing.



Single and Two-Gang Miniature Switches.

The switches are of very compact construction; the mortise for the casing forms only a very small pocket. The face of the single switch is only two and one-sixteenth inches by one inch. The switch-buttons are made of black rubber. Face plates are removable and are made in either polished brass, nickel or old brass finish.

These switches are made not only in the single but also in the gang style. The horizontal gang arrangement can be furnished for switches up to six in one group. The tandem style with one switch over the other is furnished up to four switches in one group. Three-way switches can also be procured and these have been found of value, for instance, in controlling the dome light in the car tonneau from two points.

A class of small switches is also made by the company for battery service in which the switch mechanism is of somewhat less expensive construction. These switches have metal buttons. Their size and general exterior appearance is similar to those described.

The Esterline Company Will Furnish Permanent Magnets.

The Esterline Company, Indianapolis, Ind., announces that it is prepared to furnish on short notice permanent magnets of the highest quality of workmanship and electrical characteristics. The company has a complete magnet manufacturing department which has been used for the manufacture of permanent magnets for electric lighting generators for automobiles, for tachometer generators and permanent magnets for graphic instruments. J. W. Esterline, formerly professor of electrical engineering at Purdue University, Lafayette, Ind., president of the Esterline Company, has, for a number of years, been a recognized authority on the subject of magnetic materials and is the inventor of a number of instruments for determining magnetic characteristics.

Recent Developments in Indirect Lighting Fixtures for the New Gas-Filled Lamps.

In every branch of manufacturing, changes are constantly taking place. New conditions require new methods. Processes must be improved and new products developed. Probably in no other field are there such rapid changes being made as in the manufacture of lighting appliances. Lamps are constantly being improved, and with every change of lamps, either in size of bulb, shape of base or location of filament, corresponding changes must be made all along the line in reflectors and fixtures designed for use with these lamps. Public sentiment is also an ever changing factor with regard to the quantity and quality of light and the alert manufacturer must be quick to meet these new conditions.

Fig. 1.—Indirect Fixture for Gas-Filled Lamp.

The advent of the gas-filled lamp means many radical departures in the production of fixtures. Manufacturers are actively engaged in altering and developing their lighting equipment to meet the demands of this new lamp. The intrinsic brilliancy of the filament is many times that of the ordinary tungsten lamp. It is so bright and dazzling that the eye must be shielded and protected from it. Figs. 1, 2 and 3 illustrate fixtures developed to meet the situation. They completely hide the lamp filament. In each bowl is a one-piece, corrugated, silvered reflector which directs the light from the lamp to the ceiling at the proper angle. Provision is made for holding the lamp in pendent position, maintaining the correct relation between the reflector and lamp.

The heat developed in the gas-filled lamp is very intense. This is another factor to be considered when constructing indirect fixtures. This heat is not sufficient to cause deterioration of the bowl or the silvered reflector, consequently, it is not necessary to make special provision for ventilating this part of the fixture. However, the receptacle is greatly affected by the heat and special care must be exercised in providing adequate ventilation when a metal husk is used to cover the porcelain socket as shown in Figs. 2 and 3. Also the receptacle must be treated with a special finish in order to resist the high temperature.

Fig. 2.—Indirect Fixture, Ecclesiastical Type.

Some people not only like to have a room well lighted, but they want to be aware of the location of the light source as well. It is therefore necessary for the manufacturer to produce a fixture which gives this decorative feature without detracting from the quality of the light. Fig. 3 illustrates a type of fixture designed to produce this effect. The light is directed to the ceiling by a one-piece silvered reflector in the same manner as that employed in the opaque bowls. A small portion of light which comes through the opening in the bottom of the reflector is redirected by a specially designed opal glass diffuser, so as to illuminate softly the inclosing glass bowl.

The fixtures illustrated are manufactured by the National X-Ray Reflector Company, Chicago, Ill.

New Starting Switch for Small Alternating-Current Motors.

The Allen-Bradley Company, Milwaukee, Wis., has recently placed on the market a new inclosed type starting switch for alternating-current motors of 10-horsepower capacity and under. These switches are not equipped with any resistance but can be provided with protective features which thoroughly insure the motor from both overload or running single phase.

Fig. 3.—Luminous-Bowl Indirect Fixture and Section Showing Construction.

The illustration (Fig. 1) on the next page shows the new type G starting switch with complete no-voltage protection and fuse protection on the running side. The no-voltage feature is as novel as its operation is satisfactory. To the operating lever shaft are attached weighted levers which in the running position are held in an upright position by magnet coils, each phase being supplied with an individual coil. When an interruption to the line oc-

curs, these coils are demagnetized and the weighted levers swing down, there-

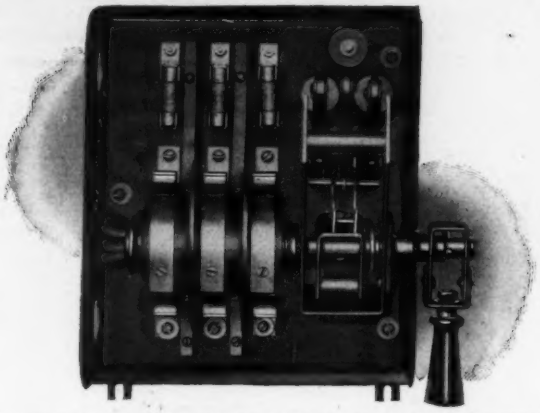


Fig. 1.—Small Alternating-Current Motor Starter, Cover Removed.

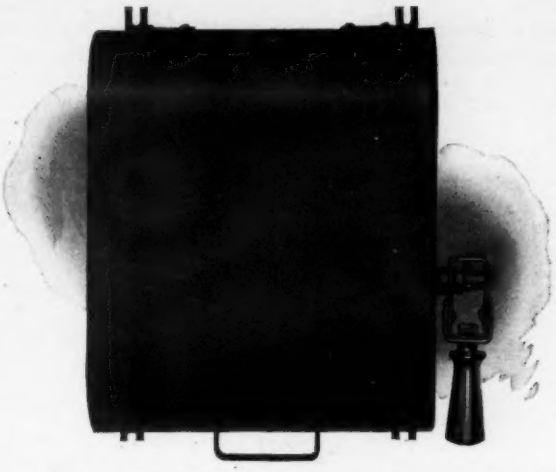


Fig. 2.—Same Starting Switch Inclosed in Steel Cabinet.

by releasing a spring latch which returns the starter to the "off" position and so stops the motor. The same operation takes place when only one phase is interrupted as its respective magnet coil is de-energized because the same is in series with that phase, and the starter released, which absolutely eliminates the possibility of the motor running single phase.

The overload device, which is not shown in Fig. 1, operates in a similar manner and can be relied upon in every instance. It is provided with a time-limit feature, which prevents the overload from operating on spasmodic changes in the motor circuit due to fluctuations in the line voltage or other causes, but in no way impairs the protective features of the same. These overload relays are adjustable and can be set at a value that will protect the motor against a bona fide overload or from running single phase, without the annoyance of having them operate frequently and stop the motor, due to trivial disturbing factors.

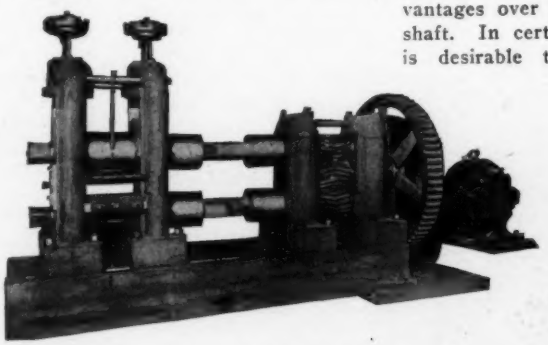
These starting switches are always inclosed in a steel cabinet, as shown in Fig. 2, which makes a very neat installation. The devices have been designed as small as possible and are made up entirely of punched-steel parts which insures the maximum strength with the minimum weight. Although the same have been on the market but a very short time, the starters have already met with remarkable success and in every instance their operation has given perfect satisfaction.

Motor-Driven Rolling Mills for Brass, Copper, Etc.

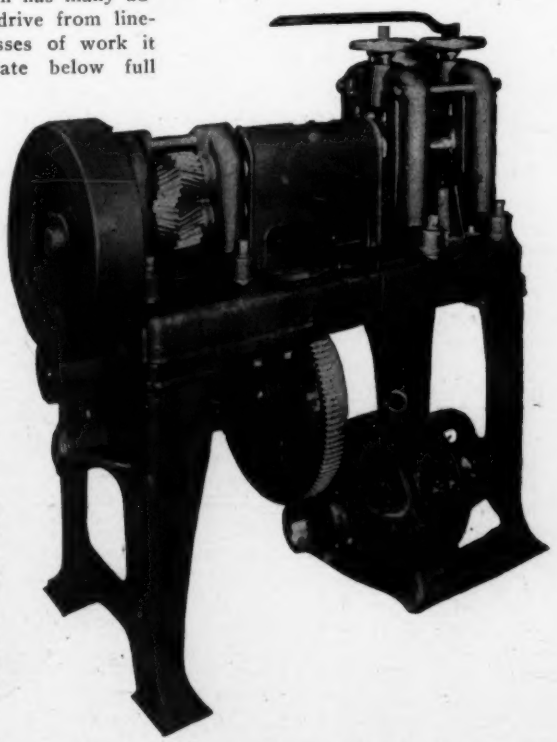
The two illustrations herewith show interesting types of rolling mills manufactured by the Standard Machinery Company, Providence, R. I. The direct motor drive shown has many advantages over belted drive from line-shaft. In certain classes of work it is desirable to operate below full speed. Controllers are supplied with the motors, allowing continuous operation at any point between half and full speed of the rolls. Motor drive allows the placing of the mill to secure the most advantageous handling of material, regardless of the location of line-shaft.

The large mill, which is driven by a 90-horsepower, 850 revolutions-per-minute Westinghouse alternating-current motor, is used for the cold rolling of steel. The housing rolls are 11 inches in diameter, and 12-inch face, and the intermediate roll is 5 inches in diameter. The gearing is triple-trained and is very substantial. The use of roller bearings effects a large saving in power. The mill is designed for economical operation and long wear in heavy service.

The small mill, driven by a 3.5-horsepower, 1,150 revolutions-per-minute Westinghouse direct-current motor, is for manufacturing jewelers' use. The hand wheels for setting down the rolls



Motor-Driven Rolling Mill.



Motor-Driven Jewelers' Rolling Mill.

are equipped with micrometer adjustment for accurate work. The rigid construction and carefully cut gears insure the work coming out smooth and free from waves. With the motor located as shown, the entire outfit requires no more space than the rolling mill itself.

High-Sensitivity Galvanometer.

The moving-coil galvanometer has been well known for many years but it is only recently that it has been subjected to a thorough theoretical study. This is due to the fact that the problem is by no means a simple one, as will be obvious to those who have followed the work of Ayrton & Mather, Jaeger, Stewart, Einthoven, White and others. These investigators have so worked out the fundamentals of the problem that it is possible to make galvanometers which approximate with a fair degree of closeness predetermined values for sensitivity, resistance, period and external critical damping resistance. In designing a galvanometer empirical rules need no longer be resorted to.

High-Sensitivity Galvanometer.

With the work of the men mentioned above as a basis the development department of the Leeds & Northrup Company, Philadelphia, Pa., has devoted three years of active work to a thorough investigation of the theory and practical designing of galvanometers and to tests of the various materials involved in their construction. The most noteworthy result of this work is the new high-sensitivity galvanometer described below.

As to the sensitivity of this new galvanometer the makers claim that with an instrument of 12 ohms internal resistance, critically damped on an external resistance of 25 ohms a sensitivity of 11 milimeters per microvolt at one meter's distance is obtained with the critical damping resistance in series. This is equivalent to a sensitivity of 34 milmeters per microvolt when the electromotive force is impressed directly across the terminals of the galvanometer. The period of this instrument is 7.5 seconds.

For work involving a high-resistance galvanometer, a sensitivity of 10,000 megohms is claimed, which is equivalent to 10^{-10} amperes. The period of this instrument is 17.5 seconds.

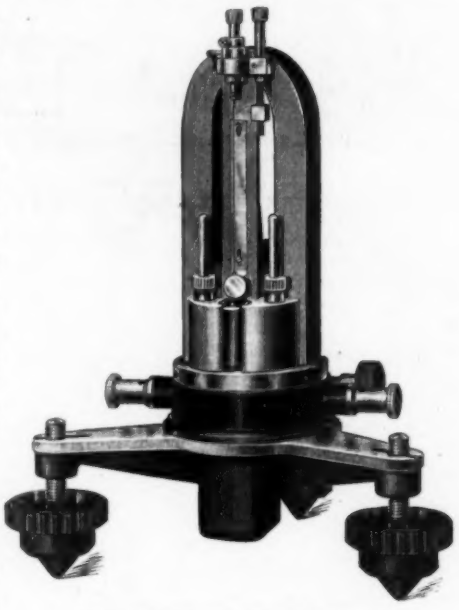
By providing the instrument with a radial field, the makers have reduced, as far as possible, the effects of the residual traces of magnetic impurities which no one has ever succeeded in eliminating entirely from the moving coil. By means of the radial field they have also secured angular deflections that are very nearly proportional to the current.

The coil is wound of specially selected wire, as free as possible from magnetic impurities. Every effort has been made to reduce the weight of the moving coil to a minimum.

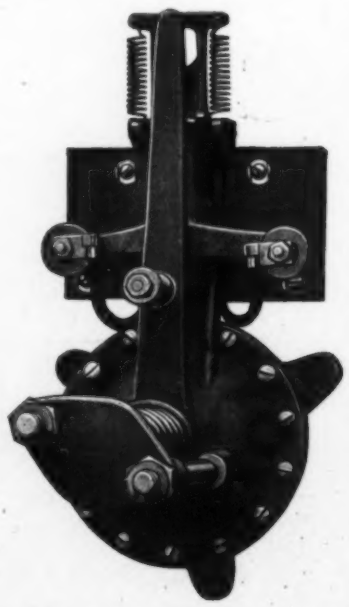
Convenient means have been provided for the zero adjustment of the coil. Rough adjustment is effected by means of a thumb-screw on top of the instrument. By turning a second thumb-screw on the base of the galvanometer a fine adjustment is secured and without jarring the instrument.

Contrary to what might be expected in an instrument of this sensitivity the air gap through which the coil moves is large with the resulting advantage that the instrument is quite readily set up and does not require tedious levelling.

The instrument is shown in the illustrations with the nickel-plated cylindrical cover in place and also with the cover removed. In the second illustration the system is plainly visible. The entire moving system may be readily removed for the quick replacing of suspensions. If desired, two or more complete systems may be used with the magnet and frame.



Galvanometer with Cover Removed.



Automatic Pressure Regulator for Motors.

New Automatic Pressure Regulator for Small Motors.

The double-pole diaphragm-type pressure regulator illustrated here is a new device for automatically controlling small direct-current or alternating-current motors operating on pressure systems. This regulator stops the motor when the maximum pressure desired is reached and starts it again when the pressure drops to the low value for which it is set. For capacities within the limits for which it is designed (one horsepower for direct-current and five horsepower for alternating-current motors) this regulator controls the operation of the motor without an additional magnetic switch and automatically maintains pressure in the systems between given limits. It is made by the Cutler-Hammer Manufacturing Company, Milwaukee.

Direct-Current Motors for Printing Presses and Linotype Machines.

A new line of direct-current motors designed especially for use in printing establishments has been placed on the market by the Robbins & Myers Company, Springfield, O. These motors are made in two types, that designated as type R being made in four and five-horsepower sizes and intended for printing-press drive. The type IL motors are made in three sizes, namely, one-quarter, one-third and one-half horsepower, respectively; these latter motors are designed particularly for operating linotype or monotype casting machines.

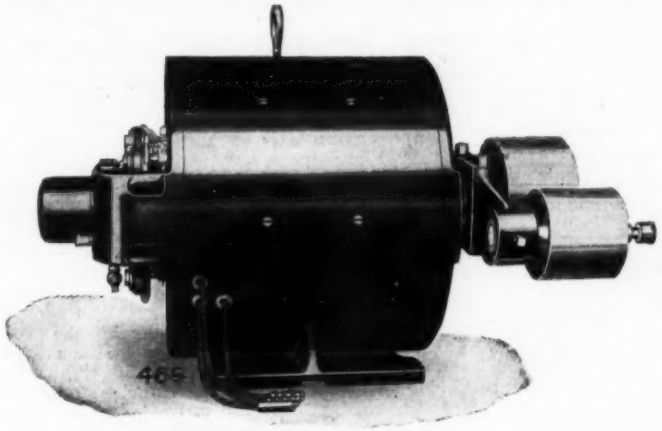


Fig. 1.—Direct-Current Printing-Press Motor.

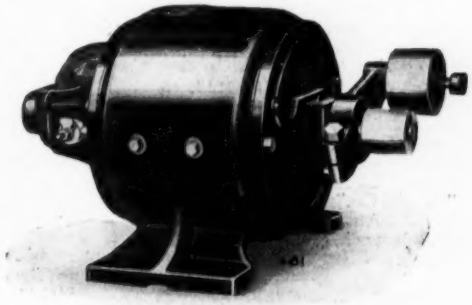


Fig. 2.—Linotype-Machine Motor.

The type R motors are provided with grey cast-iron or cast-steel frames. These frames are of the open ventilated type and have four poles bolted in, the poles being made of soft, laminated, annealed steel. Commutating poles are provided to permit sparkless commutation at variable loads and speeds. The armature bearings have bronze bushings and are lubricated on the oil-ring principle. Covers are provided for the upper halves of the end heads to prevent dirt or oil dripping onto the armature or commutator.

The armature coils are form wound, taped and dipped in a special insulating compound. The commutators are made of pure hard-drawn copper and the segments are insulated by a selected grade of soft amber mica. A sliding base is provided for the motors of this type; this has an adjusting screw at each end for adjustment of belt tension. To increase the arc of belt contact and also to permit further adjustment of belt tension the motors can also be supplied with an idler pulley of simple and yet effective design. The idler arm is attached in such a way that it can be adjusted for any angle of belt drive. This construction is shown in Fig. 1. These motors do not vary more than ten per cent in speed from no load to full load. By means of field resistance, the speed of the motors can be increased 100 per cent over the rated speed.

The type IL motors have cast-iron frames with four poles for the two larger sizes; the one-quarter-horsepower machine is of bipolar construction. The pole pieces in all sizes are laminated. In the two larger sizes the armature coils are form wound; in the smaller size the coils are wound directly in the slots of the armature core. The complete armature is dipped in insulating varnish and then baked. It is then carefully balanced and given a rigid inspection and test. These motors are provided with an idler pulley, as shown in Fig. 2. For mounting on monotype machines the usual method is to bolt the base of the motor to the vertical face of the machine base. For this purpose the end heads of the motor are turned through 90 degrees from their position in floor mounting. To prevent metal falling onto the brushes, commutators or other part of the armature, the upper halves of the motor heads are inclosed with removable covers, which have a fine-mesh brass screen to permit ample ventilation. These motors are provided with no-voltage-release starters.

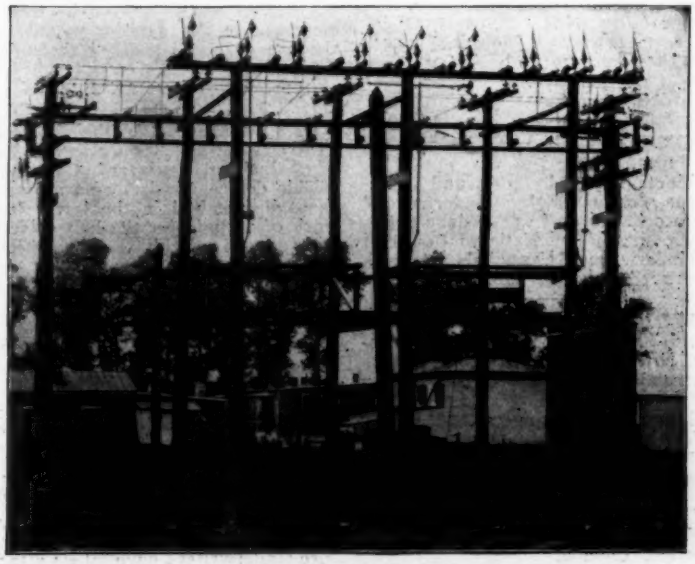
A Unique Switching Station.

The accompanying illustration showing the steady trend toward more extended use of pole-top switches is of special interest at this time when so much discussion is taking place as to the use of air-break equipment.

This particular 13,200-volt installation consists of three three-phase switches designed to open loaded circuits, and 21 single-pole weatherproof disconnecting switches, all of the standard form manufactured by the Delta-Star Electric Company, Chicago.

The equipment controls three lines feeding two underground and one overhead system. The station is built on nine 40-foot poles and gives sufficient space for the necessary potheads, arresters and busbars.

A distinct advantage of this station is that the open or closed position of each switch is easily apparent.



Outdoor Switching Station.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

ATTACHMENT PLUGS, Fuseless. —The Bryant Electric Company. Bridgeport, Conn.

"Bryant."

One ampere, 250 volts, three amperes, 125 volts; "New Wrinkle" attachment plug with switch rosette, catalog No. 464.

Approved August 10, 1914.

BUSHINGS, Porcelain. — Federal Electric Company, Lake and Desplaines Streets, Chicago, Ill. For Federal Sign System (Electric), Chicago, Ill.

"F. E. Co." screw clamp bushings, types A1-A6 inclusive.

Clamp washer bushings, types S2, S3.

Approved July 27, 1914.

CABINETS. — The Berry-Glosser Company, 126 East Center Street, Marion, O.

Cabinets shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Approved July 29, 1914.

CABINETS.—The Dill Manufacturing Company, 684 East Eighty-second Street, Cleveland, O.

Cabinets shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Approved July 31, 1914.

CABINETS.—General Electric Company, Schenectady, N. Y.

"G.E." fuse boxes. Cast-iron boxes containing cutouts for Edison plug or standard cartridge-inclosed fuses, 250 volts, catalog Nos. 48,709-48,714 inclusive, 58,716-58,719 inclusive, 59,643 and 59,644; 600 volts, catalog Nos. 48,715-48,720 inclusive.

Approved August 11, 1914.

CABINETS. — George Steingruber, Hazelhurst, Miss.

Cabinets shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Approved July 30, 1914.

CUTOUT BASES, Plug Fuse.—New Haven Electric Manufacturing Company, North Haven, Conn.

Porcelain cutout bases for Edison plug fuses.

All types, 0-30 amperes, 125 volts, catalog Nos. 51,935, 52,135, 52,165, 52,-199, 52,587, 52,965, 58,020, 58,042.

Approved August 11, 1914.

FLEXIBLE CORD.—Eugene F. Phillips Electrical Works, Limited, Montreal, Canada.

Marking: Two red threads cabled with the copper strand. Flexible cords shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, have a label attached to each coil.

Approved August 10, 1914.

FLEXIBLE CORD, Portable, for Electric Heaters.—John W. Gottschalk Manufacturing Company, Lehigh Avenue and Mascher Street, Philadelphia, Pa.

Tag on coil to read: "Nat'l Elec. Code Standard."

Marking: One white and one black thread, twisted, and parallel to the conductor under the asbestos braid.

Approved August 11, 1914.

HEATERS, Electric. — American Bread Wrapping Company, 509 Fisher Building, Chicago, Ill.

"American" type A electric bread wrapper sealer, 4.5 amperes, 110 volts, 2.25 amperes, 220 volts, consisting of an adjustable wooden bed with side plates of aluminum. A heater element is provided for each side plate and the bed. The heat from the heating elements seals the paraffin wrappers on the bread as it is passed through the device.

Approved August 11, 1914.

MIMEOGRAPH MOTOR DRIVE STAND.—A. B. Dick Company, 730-38 West Jackson Boulevard, Chicago, Ill.

This device consists of a motor and rheostat installed in the lower framework of a stand for the belt drive of a mimeograph machine. Connection to the motor and rheostat is made through a separable attachment plug and portable reinforced cord connected to a fuseless rosette. The rosette and rheostat are inclosed in a cast-iron case.

Approved August 4, 1914.

PANELBOARDS. — Electrical Construction Company, 312 Twelfth Street, Oakland, Cal.

Panelboards shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Approved July 29, 1914.

PANELBOARDS. — NePage, McKenny & Company, Seattle, Wash.

Panelboards shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Approved July 31, 1914.

PICTURE MACHINES AND APPLIANCES. — Williams, Brown & Earle, Incorporated, 916 Chestnut Street, Philadelphia, Pa.

A combination of two film magazines mounted in an iron frame and designed to inclose reels of films during the process of rewinding. One of the magazines is provided with a spindle driven by means of gearing from a crank, and roller valves are provided on adjacent sides of the magazines between which the film is run for inspection during the rewinding process.

Approved August 4, 1914.

PICTURE MACHINES AND APPLIANCES.—Speed Controller Company, Incorporated, 257 William Street, New York, N. Y.

Arc controller, consisting of a motor, switch and fuses, to be connected across the carbons of a hand-feed arc lamp, and a centrifugal device, direct-connected to the motor, which operates through a rod extending to the lamp to feed the carbons after the arc has been started by hand.

The motor, supplied by the Speed Controller Company, and expressly approved for this purpose, is made by the Peerless Electric Company, and is rated one-twelfth horsepower, 115 volts, direct current.

For use with approved moving picture machines.

Approved August 14, 1914.

RECEPTACLES, For Attachment Plugs.—The Bryant Electric Company, Bridgeport, Conn.

Bryant flush receptacles.

"Chapman" 12 amperes, 250 volts, with fuseless attachment plug, catalog No. 486.

Approved August 10, 1914.

RECEPTACLES, For Attachment Plugs.—H. T. Paiste Company, Thirty-second and Arch Streets, Philadelphia, Pa.

Paiste separable plug receptacles, 660 watts, 250 volts.

Flush type, catalog Nos. 405-407 inclusive, 415, 418-423 inclusive.

Wall type, catalog Nos. 446 and 448.

Conduit box type, catalog Nos. 444 and 4254.

Chandelier plug, catalog No. 413.

Edison base adapter, catalog No. 404.

Approved August 11, 1914.

RECEPTACLES, Standard.—Appleton Electric Company, 214 North Jefferson Street, Chicago, Ill.

Keyless, 660 watts, 250 volts.
Conduit box, catalog Nos. 7670-72 inclusive, 7680-82 inclusive, 7730-31, 7740-41.
Approved August 6, 1914.

RECEPTACLES, Standard.—General Electric Company, Schenectady, N. Y.
"G. E." porcelain shell.
Keyless.
Sign, catalog No. GE556.
Approved August 10, 1914.

RECEPTACLES Standard.,—V. V. Fittings Company, 713 Cherry Street, Philadelphia, Pa.
Keyless, conduit box or sign type. Catalog No. 513.
Approved August 4, 1914.

RECEPTACLES, Standard. — The Tregoning Electric Manufacturing Company, 418 Prospect Street, Northwest, Cleveland, O.
"Tregoning" receptacles, 660 watts, 250 volts.
Cleat, catalog No. 50,715.
Approved July 30, 1914.

SHADEHOLDERS. — The Bryant Electric Company, Bridgeport, Conn.
"Uno" shadeholders, catalog Nos. 501-06 inclusive. These shadeholders are designed to thread over spiral socket shells as supplied on "Bryant" or "Perkins" sockets and receptacles.
Approved July 25, 1914.

SIGNS, Electric.—The United States Sign Company, Gadsden, Ala.
Electric signs shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.
Approved July 30, 1914.

SOCKETS, Candelabra and Miniature.—The Bryant Electric Company, Bridgeport, Conn.
"Bryant" 75 watts, 125 volts.
Miniature. Turn, brass-shell, catalog No. 473.
Candelabra: Turn, brass-shell, catalog No. 474.
Approved August 10, 1914.

SOCKETS, Standard.—Weber Electric Company, Schenectady, N. Y.
Brass-shell electrolier sockets.
Key, 250 watts, 250 volts, catalog Nos. 1000, 1003, 1006, 1009, 1048, 1069, 1090, 1093, 1096, 1099, 1290, 1293, 1296.
Keyless, 660 watts, 250 volts, catalog Nos. 1001, 1004, 1007, 1028, 1049, 1088, 1091, 1094, 1097, 1100, 1168-69, 1188-98 inclusive, 1200, 1291, 1294, 1297.
Pull, 250 watts, 250 volts, catalog Nos. 1002, 1005, 1008, 1029, 1068, 1089, 1092, 1095, 1098, 1101, 1292, 1295, 1298.
Approved August 1, 1914.

SOCKETS, Standard.—E. H. Freeman Electric Company, Trenton, N. J.
Porcelain-shell sockets: Keyless, 660 watts, 250 volts, catalog No. 165.
Standard for use only in places where they will not be exposed to hard usage.
Approved August 10, 1914.

SOCKETS, Standard.—General Electric Company, Schenectady, N. Y.
"G.E." brass-shell sockets, locking type.
Key, 250 watts, 250 volts, catalog Nos. GE435-37-40-42-44-58-60-62-65-67.
Keyless, 660 watts, 250 volts, catalog Nos. GE436-38-41-43-45-59-61-64-66-68.
Approved August 11, 1914.

SOCKETS, Standard.—E. H. Freeman Electric Company, Trenton, N. J.
Brass-shell sockets.
Key, 250 watts, 250 volts, catalog Nos. 122, 124.
Keyless, 660 watts, 250 volts, catalog Nos. 123, 131.
Pull, 250 watts, 250 volts, catalog Nos. 169, 173.
Approved August 11, 1914.

SOCKETS, Weatherproof.—General Electric Company, Schenectady, N. Y.
"G.E. Co."
Porcelain-shell, catalog Nos. GE469, GE530.
Approved August 10, 1914.

SWITCHES, Automatic. — Leader Iron Works, Decatur, Ill.
"Leader" automatic pressure regulator, Fig. 239-F, rated 25 amperes, 250 volts. For air pressure not in excess of 140 pounds per square inch, or water pressure not in excess of 50 pounds per square inch.
A spring-actuated, carbon-contact switch, in a cast-iron housing. Lever carries the movable contacts which operate with a quick make-and-break action. The spring and levers are actuated by the variation of air or water pressure on a diaphragm within a chamber attached to the switch base.
Approved August 6, 1914.

SWITCHES, Automatic. — A. G. Electric & Manufacturing Company, 905 Howard Avenue, North, Seattle, Wash.
250 volts, 600 amperes or less.
"A. G." remote release switch consisting of a National Electrical Code standard knife switch normally held closed against the tension of springs by a catch on the armature of a magnet coil. The switch may be opened by closing the magnet-coil circuit through momentary contact switches located at remote points.
Standard when used with approved momentary contact switches and control circuit installed in accordance with Class C requirements of the National Electrical Code.
Approved August 4, 1914.

SWITCHES, Combination Cutout.—The Perkins Electric Switch Manufacturing Company, Bridgeport, Conn.
"Perkins" double-pole snap switches combined with Edison plug cutouts, 10 amperes, 125 volts, catalog Nos. 2599, 2600.
Approved August 18, 1914.

SWITCHES, Combination Cutout.—The New Haven Electric Manufacturing Company, North Haven, Conn.
Porcelain-base knife switches combined with Edison plug or cartridge-inclosed fuse cutouts. 30 amperes, 125 volts.
Double-pole, catalog Nos. 5701, 5704.
Three-pole, catalog Nos. 5703, 5705.
Approved August 3, 1914.

SWITCHES, Pendant Snap.—Union Electric Company, Hamilton Avenue and Clark Street, Trenton, N. J.
Single-pole (two-button type), 250 volts and 125 volts.
Approved August 11, 1914.

SWITCHES, Push-button Flush.—The Bryant Electric Company, Bridgeport, Conn.
"Bryant" or "Perkins."
Combination switch and pilot lamp mounted with single face plate.
Emergency switch for use with hospital systems.
Approved August 4, 1914.

SWITCHES, Surface Snap.—General Electric Company, Schenectady, N. Y.
"G. E." with metal covers.
Single-pole 600 volts, catalog Nos. 89,595, GE863.
Three-way, 600 volts, catalog No. 89,-596.
Approved August 4, 1914.

SWITCHES, Surface Snap.—General Electric Company, Schenectady, N. Y.
"G. E." ceiling switches.
Two-circuit, catalog Nos. GE136, GE137.
Three-circuit, catalog Nos. GE138, GE140.
Approved August 5, 1914.

SWITCHES, Surface Snap. — The Bryant Electric Company, Bridgeport, Conn.
"Bryant" or "Perkins."
Single-pole, 125, 250 and 600 volts.
Double-pole, 125, 250 and 600 volts.
Three-way, 125, 250 and 600 volts.
Two-circuit, 125, 250 and 600 volts.
Three-heat switch, 600 volts.
Series-multiple, 125 and 250 volts.
Three-circuit, 125 and 250 volts.
Four-way, 125 and 250 volts.
Two-speed, 125 and 250 volts.
Three-speed, 125 and 250 volts.
Three-speed for fan motors 125 and 250 volts.
Panelboard switch, 250 volts.
Ceiling switches, pull type, 125 and 250 volts.
Also above types with lock attachment and with metal, porcelain or composition covers.
Approved July 25, 1914.

SWITCH BOXES.—Chicago Fuse Manufacturing Company, 1014-1020 West Congress Street, Chicago, Ill.
Single and sectional gang types for use with rigid conduit or flexible tubing.
"Union," Types AB, BE, DC, DE.
"Gem," Types A to E inclusive, S. X.
Approved July 25, 1914.

TUBING, Flexible. — Alphaduct Company, 136 Cator Avenue, Jersey City, N. J.
Marking: Yellow thread in or back of lining.
Flexible tubing shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters has label attached to tubing.
Approved August 11, 1914.

WIRES, Rubber-Covered.—Eugene F. Phillips Electrical Works, Limited, Montreal, Canada.
Marking: Two red threads parallel in braid with one red thread crossing.
Rubber-covered wires shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached to each coil.
Approved August 7, 1914.

Current Electrical News

NORTH ATLANTIC STATES.

ROCKLAND, ME.—At the annual meeting of the Rockland, Thomaston & Camden Street Railway it voted to construct a new line to Warren with a view to furnishing electric lights.

LYNN, MASS.—The white light section of the city is to be extended. If plans are completed Blake & Willow Streets will be included in the district lighted by new luminar-series arc-type lamps with ornamental poles.

MANCHESTER, MASS.—The Manchester Electric Company is arranging to install a new cable the entire distance from the Manchester-Beverly line to the electric light station on Summer Street, at an expense of some $5,000.

SHIRLEY, MASS. — The Shirley Electric Company has been granted pole locations on Shaker Road, where the company proposes to build a high-tension line from the Samson Cordage works.

BELLEVILLE, N. Y.—The Public Service Commission has approved the construction of an electric light plant and transmission line in Belleville, and a franchise has been granted to Harlow E. Ralph.

NEWBURGH, N. Y.—The Central Hudson Gas & Electric Company is preparing to remove its high-tension wires from Montgomery Street and to place them in underground conduits which will be placed in Grand Street. This work will be done next spring.

ROCHESTER, N. Y.—The Council will install an additional light plant on Plymouth Avenue. Address the city clerk.

BELLEFONTE, PA.—The Slab Cabin Electric Company has been incorporated to operate in Ferguson Township with office at Bellefonte. The capital is $5,000. A. W. Lee is among the incorporators.

CLEARFIELD, PA.—A charter has been granted to the Rossiter Electric Company to operate in Canoe Township with offices at Clearfield. The capital is $5,000. A. J. Musser is among the incorporators.

GETTYSBURG, PA. — Whether or not Gettysburg shall have a municipal lighting plant is now a question for the Public Service Commission to determine, the ordinance providing for the erection and conduct of the plant having been passed at a meeting of the Town Council and certificate of convenience has been asked of the Commission.

HARRISBURG, PA.—An application for a Pennsylvania charter of incorporation for the Washington-Monongahela Electric Street Railway Company will be made by R. R. Reed, T. B. H. Brownlee and A. M. Linn. The new concern will construct street railways to be operated by electric power. S.

HARRISBURG, PA.—Application will be made for a Pennsylvania charter of incorporation for the New Sewickley Township Electric Company by H. L. Mitchell, L. C. Lamb and R. M. Evans. The new concern will manufacture and supply electric heat and power in the township of New Sewickley. S.

TITUSVILLE, PA.—Frederick W. Garvin, of New York, representing the holders of $300,000 worth of bonds of the Titusville Electric Traction Company bid in the property rights and franchises when the property was offered at public sale in Titusville. It is understood that the new owners will reorganize the company and completely overhaul the property and complete the construction of the cross-country line from Cambridge Springs to Tyronville, giving a connection with other traction lines.

SOUTH ATLANTIC STATES.

HOMESTEAD, FLA.—This city will ask the legislature to amend its charter increasing its bonding capacity. The city proposes to establish a municipal lighting system and make other improvements. Address the mayor for further information.

PABLO BEACH, FLA.—The Council is planning to establish a municipal light system. Address the mayor for information.

FORT MEADE, FLA.—This city has voted $25,000 of bonds for establishing an electric lighting plant.

NORTH CENTRAL STATES.

ATHENS, O.—The City Council, which has for several weeks been working over ordinances by which the city will be supplied with current by the electric company at Floodwood, O., is getting things straightened out. It is said that the electric company at Floodwood will purchase the city's present electric plant. The city is also contemplating the use of current to be furnished by the company in pumping water for its water system, holding its present steam pumping plant in reserve, and the company will furnish estimates on the cost of special machinery for this purpose. M.

CINCINNATI, O.—The Central Vine Street Business Association, Silas Waters, president, is planning to secure the construction of a boulevard-lighting system for part of Vine street.

DAYTON, O.—An initiative petition has been filed with the City Commission calling for an election for the purpose of determining whether to construct a municipal electric light and power plant. If the petition is indorsed by a meeting to be held in accordance with the charter the commissioners will fix a date for the election. L.

PORTSMOUTH, O.—Street lamps will probably be placed in the Sunnyside addition, in response to the request of residents. It was suggested by the Council that some lamps in the public square might be removed and placed in Sunnyside, but new lamps will probably be purchased instead.

SANDUSKY, O. — The Municipal League gave notice that the Council will be asked to enact legislation required for bringing about a municipal lighting plant election. A $200,000 bond issue is proposed.

MADISON, IND.—Additional first-mortgage bonds to the amount of $25,000 will be issued by the Madison Light & Railway Company, the issue having been approved by the Public Service Commission, and with the proceeds will construct a line to Hanover, Ind., and improve the local plant and system. Boilers and engine and a generator are to be included in the new equipment. The line to Hanover, which the local company is under contract to supply current to for a year, is now being constructed.

LIBERTY, IND.—The proposition to build an electric line from Hamilton, O., to Richmond, Ind., passing through Union County, Ind., has been started by the citizens of Liberty. The plan includes the extension of the Indianapolis and Connersville traction line from Connersville, connecting with the Richmond line east of Liberty, with a station at Liberty. The companies will ask for subsidies amounting to $60,000. The matter is now in the hands of the Liberty Commercial Club.

PATOKA, ILL.—An effort is being made by the citizens of Patoka, Ill., to establish an electric plant in that city for lighting purposes. Indications are that the effort will be successful. Z.

ELMWOOD, ILL.—L. W. Lemon, an engineer from Clinton, Ill., is preparing estimates and specifications for a municipal lighting plant in this city. Z.

KIRKWOOD, ILL.—The Kirkwood Board of Aldermen voted to submit the expenditure of $17,000 this fall for improvement of the municipal electric light plant.

YORKVILLE, ILL.—Upshaw Hoard, of Aurora, is promoting a project to build an electric line between Yorkville and Sandwich.

BATTLE CREEK, MICH. — Contractor J. T. Adams, of Columbus, O., has the contract to construct an electric road to connect Coldwater and Battle Creek. The road will be 28 miles long and touch Beadle Lake, Newton, Lee Lake, Burlington, Girard, Morrison Lake and Coldwater, with a probable spur to Union City, four miles from the main line.

DETROIT, MICH. — Sealed proposals for furnishing machinery and equipment for a garbage reduction plant will be received at the office of the Commissioner, September 21. The

specifications include engines and generators, conveying machinery, railroad track scales and railroad garbage cars, etc.

FENTON, MICH.—The Council is planning ways and means to install boulevard lighting.

ELKHORN, WIS. — $75,000 bonds have been sold for an electric railway between Lake Geneva and Whitewater. Plans are being prepared. C.

MONDOVIA, WIS.—C. A. Dornfield, of Kenosha, is preparing plans for rebuilding the electric light plant.

NEW RICHMOND, WIS. — Manager A. S. Wells of the Wells Electric Construction Company, will erect an electric lighting plant. C.

DULUTH, MINN. —Commissioner Merritt of West Duluth estimates that the cost of an electric light substation in West Duluth that would supply that section of the city and other adjacent sections, would cost $90,000.

ELK RIVER, MINN.—The Elk River Council has granted F. D. Waterman an electric light franchise. C.

FRANKLIN, MINN.—A franchise has been granted and the Whorland Electric Light Company will furnish the power for lighting. C.

HIBBING, MINN.—There is a proposition here in favor of the village building and operating its own electric light plant because of the alleged poor service now being received.

PIPESTONE, MINN.—A big electric lighting project is being worked out in this county and if the plans mature the Pipestone Electric Light Company will build lines to Trosky, Edgerton and Jasper to furnish those towns with electricity for lighting and power purposes.

SO. STILLWATER, MINN.—The Consumers' Power Company will furnish this city with power for lights.

ST. PAUL, MINN.—More electric lights and a plant owned by the city at which power will be supplied for the lighting of streets and public buildings in St. Paul are planned by Oscar Keller, commissioner of public utilities.

WACONIA, MINN.—The town is agitating the question of an electric lighting system. C.

REINBECK, IOWA.—Fire destroyed the electric light plant here. Address the city clerk in regard to prospective reconstruction.

ROCKWELL CITY, IOWA. — A special election will be held in Rockwell City on September 14 to decide the question of granting a 20-year franchise to the Calhoun County Public Service Company for the use of streets and alleys for the erection of electric light poles.

DIXON, MO.—Certificate of incorporation has been filed by the Dixon Power & Lighting Company of Dixon.

WILLISTON, N. D.—G. H. Drown will soon let the contract for the construction of 60 miles of electric railroad. C.

DAVIS, S. D.—A franchise has been granted to the Milwaukee Company for installing an electric lighting system.

OTTAWA, KANS.—W. B. Strang, head of the Strang interurban electric line now running between Kansas City and Olathe, is taking up a proposed plan of extending the line from Olathe through Edgerton, Gardner, Wellsville, Baldwin to Ottawa. At present Mr. Strang is busy negotiating with a government representative to establish an aerial station at Tower Grove, located on the Strang line near Kansas City.

SOUTH CENTRAL STATES.

BEATTYVILLE, KY.—The City Council has authorized the sale of a 20-year electric light franchise. Bids are being received by R. B. Jackson, mayor, and the franchise will go to the best bidder. G.

BIDDEL, KY.—Biddel Telephone Company has been incorporated with a capital of $400 by T. J. Penn and others.

RICHMOND, KY.—Appearing before the City Council S. L. Woodruff, manager for the Cumberland Telegraph & Telephone Company, asked for a renewal of the company's charter, which has expired. A central energy plant to take the place of less modern equipment now in use at slightly increased cost for service is a proposal made by Manager Woodruff.

NASHVILLE, TENN.—The Nashville-Gallatin Interurban Company plans to issue $300,000 in bonds to aid in the extension of the present line from Goodlettsville to Springfield, and other towns in Tennessee, and to Guthrie, Hopkinsville and other towns in Kentucky.

EL PASO, TEX.—The electric railway company here will enlarge its power plant by installing additional machinery and equipment at a cost of about $300,000. An increased capacity of 5,000 kilowatts will be given to the plant. D.

GONZALES, TEX.—The Gonzales Water Power Company will build a dam across the Colorado River and construct a hydroelectric plant which will have a capacity of 1,100 horsepower.

SAN ANTONIO, TEX.—The San Antonio, San Jose and Medina Valley Railway Company, which was organized to construct an interurban electric railway between San Antonio and Medina Lake, about 28 miles, is making good progress with its plans. Liberal bonuses in aid of the project are being raised by the people along the route. D.

SAN MARCOS, TEX.—The San Marcos & Luling Interurban Railway Company will construct a line between San Marcos and Luling, about 20 miles. The road will traverse the valley of the San Marcos River. D.

THREE RIVERS, TEX.—This city is having plans prepared for the construction of an electric light plant.

WESTERN STATES.

FAIRVIEW, MONT.—The Jenison Light & Power Company has filed articles of incorporation at Fairview, giving its capital stock as $100,000, of which $50,000 has been subscribed. The purpose of the company is to erect an electric light and power plant near there.

WHITE OAKS, N. M.—The Wild Cat Mining Company has under consideration the construction of an electric power plant and the building of a power transmission line to its mines in Nogal Canyon and to Carrizozo. A. B. Graham, J. H. Fulmer, Jr., and W. H. Tupper, all of Mishawka, Ind., are largely interested in the company. D.

MULLAN, IDAHO.—The Montana Power Company will construct a new high-power transmission line from this city to Wallace. Surveying crews are laying out the proposed route at this time, and it is understood the improvement will be completed this fall. O.

PUYALLUP, WASH.—The Mutual Electric Light & Power Company, recently organized and incorporated for $25,000, has been granted a franchise by the Pierce County Commissioners to erect telephone, light and power poles, and to string transmission wires along the county roads of Pierce County. Farmers living south of the Puyallup River, between Tacoma and Puyallup, are to be furnished with current for lighting and power. O.

SEATTLE, WASH.—A franchise to construct and maintain a light and power line from Bryn Mawr to Renton, and along the line of State Aid Road No. 7 has been granted to the Municipal Lighting Commission by the King County Commissioners. The franchise is for a period of 38 years, and the privilege opens a large district to municipal service. Active construction will be ordered shortly. O.

CLAVEL, ORE.—The Pacific Power & Light Company, of Astoria, will be requested shortly by this city to install an electric lighting system here.

ALAMEDA, CAL.—Articles of incorporation have been filed for the Mountain Light & Water Company, a $25,000 corporation, with headquarters at Alameda. The directors and stockholders are J. F. Hughes, M. J. Russell and Grace L. Stillwell.

PROPOSALS.

POLICE SIGNAL SYSTEM.—Sealed proposals will be received by C. H. Hughes, director of public safety, City of Mansfield, O., September 23, for the furnishing and installing of a police signal system, in accordance with the specifications.

ELECTRIC WIRING.—Bids will be soon opened for the electric wiring of the new school which is being planned to be erected at Chartiers Township, Washington County, Pa. Information may be had at the office of J. W. Vester, architect, Brown Building, Washington, Pa. S.

ELECTRICAL CABLE, ETC.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until October 6 for furnishing under Schedule 7285, 7,100 feet of paper-insulated single-conductor, lead-sheathed cable; 1,100 feet paper-insulated two-conductor lead-sheathed cable; and 20 terminals for single and two-conductor cable, all for delivery at Navy Yard, Mare Island, Cal.

LEAD-COVERED CABLE.—Sealed proposals will be received at the office of J. F. Barry, borough clerk, 1113 North Canal Street, Sharpsburg, Pa., until September 14, for approximately 8,000 feet of lead-covered cable containing one pair No. 14 B. & S. gauge, twisted, and four pair No. 14 B. & S. gauge straight lay copper wire with rubber insulation; and for 40 feet lead-covered cable containing three conductors, No. 2 B. & S. gauge rubber-covered wire for 5,000-volt service. For specifications apply at borough office.

INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until October 13, for furnishing the interior lighting fixtures of a one-story

building for the post office at Shelbyville, Tenn.; and until October 14 for the same for a two-story building for the post office at Jellico, Tenn., in accordance with drawings and specifications, copies of which may be obtained from the custodians of the sites or the office of the Supervising Architect.

PUMPING MACHINERY.—Sealed proposals will be received by the Board of Administration, Capitol Building, Springfield, Ill., September 21, for improvements at the Soldiers' Orphans' Home, Normal, Ill., as follows: One electrically driven deep-well pump, steel water tower, approximate capacity 40,000 gallons; cast-iron water main and accessories; turbogenerator set; switchboards and accessories. Plans and specifications for the above improvements will be furnished upon application to Major C. A. Bassett, managing officer of the Soldiers' Orphans' Home, Normal, Ill.

POWER PLANT AND TRANSMISSION LINE. — Sealed proposals for the construction of a power plant and transmission line will be received by the State Board of Hospital Trustees, West Pownal, Me., in the office of Dr. Carl J. Hedin, superintendent, Maine School for Feeble Minded, until September 18. Plans and specifications may be seen at the office of the superintendent or obtained at the office of Arthur B. Fels, engineer, 60 Union Street, Portland, Me. Each bid must be accompanied with a certified check for an amount equal to three per cent of the bid submitted.

ELECTRIC TRANSMISSION LINE AND DISTRIBUTION SYSTEM.—Bids will be received by the town of Paton, Iowa, until September 22 for its proposed transmission line and distribution system, as set forth in the plans and specifications, which may be seen at the office of the city clerk, Paton, Iowa, or at the office of the engineer, W. H. Grover, Ames, Iowa. The substation at Paron is to be included in a separate item. The construction of the transmission line and substation is to be suitable for 6,600 volts and the distribution system, 220-110 volts. A certified check for five per cent of amount of bid is required. All bids are to be filed with the city clerk.

ELECTRICAL EQUIPMENT—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until September 29 for furnishing electrical equipment for two boat cranes for hoisting and rotating, as per Schedule 7281, and one set motor-driven plate-bending rolls to bend one-quarter-inch plate to circle of eight-inch diameter 60 inches long, as per Schedule 7282, both for delivery at the Navy Yard, Brooklyn, N. Y. The Bureau will also receive bids until October 6 for miscellaneous hydrometers, glass and storage battery, rubber-syringe bulbs, glass-syringe tubes, as per Schedule 7287, for delivery at Navy Yards, Brooklyn and Mare Island; and until October 14 for furnishing eight motor-driven convertible-type fans, as per Schedule 7301, for the Navy Yard, Mare Island, Cal.; and until October 20 for miscellaneous globes, sockets, receptacles, insulators, caps, lamps and sleeves, as per Schedule 7280, for delivery at the Navy Yards, Pearl Harbor, Hawaii; San Francisco, Cal., or New York City.

FOREIGN TRADE OPPORTUNITIES.

[Where addresses are omitted they may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., and at the branch offices of the Bureau, 315 Custom-house, New York, N. Y., 629 Federal Building, Chicago, Ill., Association of Commerce Building, New Orleans, La., and 310 Custom-house, San Francisco, Cal. Apply for addresses in letter form, giving file numbers.]

NO. 13,642. SEARCHLIGHTS, RANGE FINDERS, AND AIRSHIP SUPPLIES. — A company organized by merchants in one of the principal cities of Asia, with a view to purchasing American goods direct, desires to get in touch with manufacturers of searchlights, range finders, and airship supplies in the United States. The company is in a position to purchase the searchlights for the army and the navy of that country.

NO. 13,638. ELECTRICAL APPARATUS.—An American consular officer in the United Kingdom reports that an electrical engineer and manufacturer in his district is desirous of securing the representation in the United Kingdom for an American firm specializing in electrical apparatus or general engineering.

NO. 13,639. CHURCH GLASS, LIGHTING FIXTURES, AND ORGAN.—A report from an American consul in Canada states that there is an opportunity to sell church glass, lighting fixtures, and an organ for a church shortly to be constructed in his district. The edifice will be of brick with stone facings, 120 feet long by 90 feet wide, costing $50,000.

NO. 13,580. HOTEL FIXTURES.—An American consul in a Latin-American country reports that a resident of his district will soon begin the erection of a new hotel with 100 rooms. He desires to secure catalogs of hotel furnishings, building materials, electric fittings, office furniture and fittings, etc., in fact, everything needed in establishing a first-class hotel. Correspondence should be in Spanish.

NO. 13,592. ELECTRIC VAN OR TRUCK AND RUNABOUT.—A municipal electrical engineer in South Africa would like prices and details forwarded for one Edison battery electrical van or truck, carrying 4,000 pounds, capable of ascending an incline of 1 in 8, or 12.5 per cent, and a speed on level ground of 10 to 12 miles per hour. Prices are desired for chassis only and for completed car landed at a certain South African port. Specifications should indicate full mileage for each battery charge, assuming one-half distance with full load and the other half light. Quotations are also desired for an electric runabount capable of carrying four persons. Edison batteries are desired. Prices quoted should be for complete car with accessories. The same standard voltage for both vehicles would be considered an advantage.

NO. 13,593. ELECTRIC LAMPS.—An established dealer in electrical supplies informs an American consular officer in Spain that he is desirous of introducing a line of American electric lamps in his business and would be pleased to receive descriptive printed matter of such goods, with lowest export prices.

NO. 13,601. ELECTRIC TRAMWAY CONSTRUCTION.—An American consul in Italy reports that Le Tramways Florentins, of Brussels, Belgium, which owns and operates the electric tramway system of Florence, Italy, has requested from the civil authorities permission to make extensions aggregating 12,000 feet, some of which are double track. Catalog and correspondence regarding this work, as far as furnishing supplies are concerned, should be in French, and addressed to the Direction General des Tramways Florentins, Brussels, Belgium.

NO. 13,605. SWITCHBOARD SYSTEM.—An American consul in a European country reports that he has reliable information that the telephone officials of the city in which he is located are investigating improved switchboard systems with a desire to adopt a semiautomatic system if a satisfactory one can be found. There are at present 3,800 subscribers connected with the city central. American manufacturers interested should furnish catalogs in French or Italian. Correspondence should be in either of these languages.

NO. 13,607. RAW MATERIALS FOR MANUFACTURE OF ELECTRIC LAMPS.—A report from an American consular officer in the United Kingdom states that a firm in his district would be glad to get the names of agents for American manufacturers of tungsten metal, tungstic acid, glass bulbs, tubing, rods, molybdenum wires, etc., suitable for the manufacture of incandescent lamps.

NO. 13,611. ELECTRIC MINING PLANT.—An American consul in Europe has transmitted the name of a firm who has been awarded a contract for the construction of a large tunnel in connection with the sewerage of a city in his district. The tunnel will be approximately 2.5 miles in length and will cost about $610,000. The consul has been informed that an electric mining plant will be used for the work, provided the corporation will supply current at a satisfactory price, otherwise a steam plant will be used. Should an electric equipment be decided upon, the contractors will wish to purchase an up-to-date plant and will consider offers received from American manufacturers. Catalogs sent to the consulate will be promptly submitted to the contractors.

NEW INCORPORATIONS.

BROOKLYN, N. Y.—I. Libson Company, Incorporated, has been incorporated with a capital stock of $5,000 to deal in gas and electric fixtures. The incorporators are Isaac Libson, Michael Herwitz and Michael J. Wilson.

BRISTOL, CONN.—The Ward-Smith Electric Company has filed articles of incorporation, capitalized at $2,000. The incorporators are Leland A. Ward, Tyron Smith and C. A. Ward. The company will engage in a general electrical business.

DES MOINES, IOWA.—Articles of incorporation have been filed for the Colton Company, capitalized at $50,000. The company will engage in the business of vacuum cleaners and other electrical apparatus. The incorporators are W. L. and W. A. Colton, and A. D. Struthers.

HARRISBURG, PA.—An application for a Pennsylvania charter of incorporation for the Edgcomb-Cohill Wireless Manufacturing Company will be made by A. J. Edgcomb, G. F. Clement and M. B. Cohill. The concern will manufacture and sell wireless telegraph and telephone supplies.

JERSEY CITY, N. J.—The United States Service Company has been incorporated under the laws of New Jersey with a capital stock of $10,000. The object of the concern is to manufacture electrical appliances. The incorporat-

ors are John R. Turner, H. A. Black and C. H. Jarvis, all of Jersey City.

SEITZ, KY.—Maxine Telephone Company has been incorporated with a capital of $480 by Harry Black and others.

DALLAS, TEX.—Reflecto Electric Sign Company has been incorporated with a capital stock of $10,000 by E. C. Jeffress, Ira P. De Loache and T. W. Erwin.

POUGHKEEPSIE, N. Y.—S. L. S. Electric Company has been incorporated with a capitalization of $30,000 by Ada Bolognesh, A. M. Sherer and J. B. Ball.

DUTCHTOWN, MO.—Dutchtown Telephone Company has been incorporated with a capital stock of $2,000. The incorporators are G. E. Alt, J. F. Fraser and L. F. Keller.

PLYMOUTH, ILL.—Certificate of incorporation has been filed by the Buncombe Metallic Telephone Company, capitalized at $800. The incorporators are T. A. Scott, F. E. Hendrickson and others.

HEBRON, IND.—The Hebron Telephone Company, with a capital of $10,000, has been incorporated to operate in Lake, Newton, Jasper, Porter, and LaPorte Counties. The directors are John Wilkinson, and Stanley and Marguerite Casbere.

CHICAGO, ILL.—The Chicago Electric Sign Company has been licensed to incorporate; capitalized at $5,000. It is to manufacture and deal in electric and other signs, chandeliers, goods, etc. Clark C. Worthy, L. E. Smith and E. W. Wortley are the incorporators. Z.

MANHATTAN, N. Y.—Van Har Electrical Company, Incorporated, has been granted articles of incorporation to deal in electrical supplies and engage in business as electricians. The capital stock is $50,000 and the incorporators are C. B. VanAllen, E. M. Harroun, T. J. Meehan, New York City.

CHICAGO, ILL.—Improved Combustion Company has been incorporated with a capital stock of $40,000 to buy, sell and manufacture and install any and all appliances to steam or other power plants which will diminish fuel cost and reduce operating expenses. The incorporators are Willard A. Smith, H. C. Adams, C. M. Moderwell and Carl Scholz.

PEORIA, ILL.—The National Electric & Auto Supply Company has been granted a license to incorporate. The capital stock is $75,000. The company is to manufacture and deal in electric, telephone, motor boat, automobile and aircraft supplies, accessories and novelties. The incorporators are H. H. Moody, Ralph V. Miller and Theodore E. Bass. Z.

NEW PUBLICATIONS.

PHILADELPHIA ELECTRICAL REPORT.—The annual report of the Electrical Bureau of the city of Philadelphia, Pa., for the year 1913 has been issued. The report covers electrical inspection, street lighting, police-telephone and fire-alarm systems, City Hall installation, etc.

COAL COMBUSTION.—The Bureau of Mines has issued Technical Paper No. 63, which is a preliminary report on "Factors Governing the Combustion of Coal in Boiler Furnaces," by J. K. Clement, J. C. W. Fraser and C. E. Augustine. This discusses the proper furnace conditions for getting the best results from coal and describes tests carried out under different conditions.

FINANCIAL NOTES.

The Western States Gas & Electric Company, San Francisco, Cal., has applied to the Railroad Commission for authority to create a three-year six-per-cent note issue in the sum of $1,500,000 to be secured by the trust deed of all the company's properties. The lien of the trust deed will be subsequent to the liens of the trust deeds securing the bond issue of the American River Electric Company, dated July 1, 1903, and the bond issue of the Western States Gas & Electric Company dated June 1, 1911. The company wishes to issue $1,050,000 of the notes immediately.

Dividends.

	Term	Rate	Payable
Brockton & Plymouth St. Ry. pf.	S-A	$3.00	Sept. 15
Cent. Sts. Elec. pf.	Q	1.75%	Oct. 1
El Paso Elec. com.	Q	2.25%	Sept. 15
Federal Lt. & Trac. pf.	Q	1.5%	Sept. 1
Interborough Rap. Tran.	Q	2.5%	Oct. 1
Pa. Water & Power	Q	1%	Oct. 1
Standard Gas & Elec.	Q	2%	Sept. 15
Twin City Rap. Tran. com.	Q	1.5%	Oct. 1
Twin City Rap. Tran. pf.	Q	1.75%	Oct. 1
United Trac. & Elec.	Q	1.25%	Oct. 1

Report of Earnings.

NORTHERN STATES POWER.

And subsidiaries for twelve months ended July 31:

	1914	1913
Gross earnings	$4,124,817	$3,767,721
Expenses and Taxes	1,973,387	1,858,501
Net earnings	2,151,429	1,909,220
Fixed charges	1,250,308	1,185,708
Surplus	901,120	723,511
Preferred dividends	587,068	556,930
Balance for common stock	314,051	166,581

MOBILE ELECTRIC.

Twelve months ended July 31, 1914:

	1914	1913
Gross earnings	$ 385,959	$ 380,582
Net after taxes	192,982	179,488
Surplus after charges.	105,976	95,238
Balance after preferred dividends	46,301	35,563

LEWISTON, AUGUSTA & WATERVILLE STREET RAILWAY.

	1914	1913
July gross	$ 72,565	$ 75,102
Net after taxes	31,366	35,054
Surplus after charges.	15,869	19,503
Twelve months' gross.	675,185	657,469
Net after taxes	215,861	251,022
Surplus after charges.	31,081	75,786
Balance after preferred dividends	*4,919	39,786

*Deficit.

CHATTANOOGA RAILWAY & LIGHT.

	1914	1913
July gross	$ 92,696	$ 95,521
Net after taxes	31,261	38,161
Surplus after charges.	3,131	13,283
Twelve months' gross.	1,159,210	1,162,587
Net after taxes	448,008	468,496
Surplus after charges.	123,965	184,762
Balance after preferred dividends	23,965	84,762

NORTHERN OHIO TRACTION & LIGHT.

	1914.	1913.
July gross	$351,658	$319,131
Net after taxes	145,488	133,945
Surplus after charges.	94,640	86,356
Balance after preferred dividends	79,535	73,597
Seven months' gross	2,073,359	1,816,369
Net after taxes	807,554	702,724
Surplus after charges.	454,871	384,411
Balance after preferred dividends	349,648	299,270

TWIN CITY RAPID TRANSIT.

	1914	1913
Gross for first 3 weeks in August	$ 536,227	$ 514,312
Gross from Jan. 1	5,821,424	5,469,449
July gross	825,062	773,499
Net earnings	414,288	383,966
*Surplus after taxes	181,960	144,332
Seven months' gross	5,342,615	5,004,030
Net earnings	2,545,133	2,445,272
*Surplus after taxes	954,248	807,199

*And interest, preferred dividends, rentals and depreciation.

PERSONAL MENTION.

MR. HENRY F. HOLLAND, Western representative of the Simplex Electric Heating Company, has returned to his headquarters in Salt Lake City, after three months spent in covering the Coast territory.

MR. A. B. EDES, for 14 years in various capacities with the Ohio Brass Company, Mansfield, O., recently assistant general sales agent, goes to Holabird & Reynolds, San Francisco, to become a member of their sales organization, specializing on O-B material.

MR. CURTISS B. HAWLEY, general manager of the Inter-Mountain Electric Company, is in the East attending the quarterly meeting of the Electrical Supply Jobbers' Association, Niagara Falls, Canada. He will also attend the convention of the Westinghouse lamp agents, which opens September 12.

MR. CHRISTOPHER C. CHILDERS, president of Childers & Waters, electrical contractors of Louisville, Ky., was a leading member of the Dinner Committee at the annual outing of the Louisville Builders' Exchange, held last week at Hike's Point, near Louisville, other electrical contractors of the city participating to a large extent.

MR. E. W. PHILLIPS, general manager of the Kandem Electric Company, Incorporated, (formerly the Koerting & Mathiesen Company), New York City, announces that as this firm is unable to obtain supplies from its owners and manufacturers located at Leipsig, Germany, at present or in the near future, he will terminate his association with the company on September 15. Mr. Phillips's present address is 1275 Eighty-sixth Street, Brooklyn, N. Y.

MR. J. SANDBERG and MR. THOMAS B. CULHANE, of the sales force of the Salt Lake City office of the General Electric Company, are on an extended trip in the East. Mr. Sandberg will visit his home in Chicago, and the St. Louis, Kansas City, Denver and other offices of the company for the purpose of familiarizing himself with sales methods at these points. Mr. Culhane will visit the company's factories at Schenectady, Pittsfield, Lynn, Harrison and Cleveland.

MR. FRANK WERT, of Philadelphia, Pa., where he was engaged in newspaper work, has been made head of the department of public relations of the Mahoning & Shenango Railway & Light Company, at Youngstown, O., succeeding in that capacity MR. H. D. MANNING, assistant to the president, who has found his double duties too heavy by reason of his frequent absences from the city in connection with his work in the latter position. Mr. Wert was formerly engaged in newspaper work in Baltimore and Harrisburg, and is admirably qualified for the work of maintaining amicable relations between the company and the section which it serves.

MR. W. F. RABER, the newly elected president of the Colorado Electric Light, Power and Railway Association, was born near Columbus, O., and has been connected with electric light and street railway operations for many years. Most of his early training was secured in Ohio, where he was general manager of the Mansfield Railway, Light & Power Company for three years. He operated gas and electric plants in Oklahoma for a year, and

subsequently spent five years as an operator in Iowa. He has been vice-president and general manager of the Arkansas Valley Railway, Light & Power Company, a Byllesby property, since 1911; this property operates in six counties in the southern part of Colorado, and is one of the most successful plants in the Mountain states.

MR. FRANK F. FOWLE, one of the joint receivers with David R. Forgan and Edgar S. Bloom, of the Central Union Telephone Company, has closed his New York office at 68 Maiden Lane and moved his headquarters to Chicago. The Central Union Company operates throughout the states of Ohio, Indiana and Illinois, with the exception of the territory in and around the cities of Chicago, Cleveland and Cincinnati. The plant valuation now stands on the books at about $35,000,000 and the total assets are about $41,000,000. The receivers are actively managing and operating the property and Mr. Fowle's duties as the technical expert of the receivership have made it impossible for him to continue his private practice for the time being. The receivers have taken separate offices and established their own organization, where they will occupy the entire tenth floor of the Chicago Telephone Building at 212 West Washington Street, Chicago.

MR. W. R. ALBERGER, a director and formerly general manager of the Oakland Traction Company, Oakland, Cal., has again assumed the management of the trans-bay electric lines, replacing Mr. A. W. McLIMONT, who has been in charge for a number of months representing the George C. Moore Syndicate. The outbreak of the European war is understood to have delayed Mr. Moore's plans by causing the withdrawal of English capital which had been enlisted in the project of reorganizing the traction lines with ample provision for future development. The purchasing department will be taken over by Mr. Alberger's office and Mr. L. P. Cramer. Electrical Chief Engineer Pinckly will be retained, as will most of the minor officials. These changes, it is understood, have been made in the interest of economy pending the final working out of plans for the rehabilitation of the company, and in no wise reflect upon the management of the traction lines during the Moore administration.

MR. H. H. CUDMORE has been appointed director of the Pacific Coast offices of the Mazda Publicity Bureau in the Rialto Building, San Francisco, Cal. The Mazda Publicity Bureau of the General Electric Company has been organized to assist in stimulating the sales of Mazda lamps irrespective of the brand. An aggressive localized campaign will be inaugurated for the purpose of maintaining and extending the good will in the trade mark "Mazda." Mr. Cudmore is especially well qualified for work of this character. As manager of the Brilliant Electric Company, of Cleveland, he was one of the most successful department chiefs in stimulating the sales of what became one of the most popular brand names of the National Electric Lamp Association. After leaving the Brilliant organization, Mr. Cudmore became a member of the arbitration board of the incandescent lamp companies, and in addition to this service he acted as a special representative of the Society for Electrical Development, Incorporated, being loaned by the lamp organization for his ability to arouse enthusiasm in the Society's plans, meeting in this capacity with singular success. Mr. Cudmore will be assisted by MR. A. B. BOND, who will co-operate with the central stations, MR. CLARK BAKER, who will work with the agents and dealers, and MR. F. J. BLASCHKE, who will be in charge of publicity and exhibits. The campaign will include the use of billboards, street cars, window cards and demonstration sets, enlarging upon the efficiency and economy of Mazda service. The educational features will describe in detail the work of the research departments, the laboratory organization, the manufacturing and selling helps available to the Mazda consumer.

OBITUARY.

MR. DENNIS LONG MILLER, of Louisville, Ky., member of the Fitch-Miller Company, of which T. Lindsey Fitch is the surviving member, died last week at Saranac Lake, N. Y., where he had gone for treatment for tuberculosis. The firm promoted electrical, gas and water properties. Mr. Miller was one of the leading spirits of a water power company which seeks through a bill pending before Congress, to harness the falls of the Ohio River at Louisville and develop water power. His critical illness dates from the time a year ago when he drove his automobile in front of an electric interurban car, his sister losing her life in the accident. The body was brought to Louisville for burial. Mr. Miller is survived by his wife.

MR. THOMAS E. HUGHES, manager of the Philadelphia office of the Standard Underground Cable Company, died at his residence, Atlantic City, N. J., August 27, funeral services being held in Philadelphia on Monday, August 31. Mr. Hughes had long represented the Standard company throughout its Atlantic Coast territory from Philadelphia south, and for the past 17 years had been manager of its Eastern and Southeastern branch office sales department, located at Philadelphia. During the period of his association with the company he had seen the number of its branch offices increase more than five fold, and the annual business done in the Philadelphia office territory during recent years grow to a figure equal to that of the company at large 17 years earlier. Mr. Hughes has been a well known figure in the electrical field practically from its commercial inception and a host of friends among his customers and associates will not soon forget his unusual personality with its large capacity for friendship and its unusual mental aggressiveness which was his to the end. While about to return from a visit to Bermuda for his health in the Spring of 1913 Mr. Hughes suffered a stroke of paralysis, from which he recovered sufficiently, less than a year later, to partly resume his regular duties. For a number of years he was secretary and director of the Manufacturers' Club, Philadelphia, and active and influential in securing its present location, and until his death took a great interest in the Club's activities. Prior to his connection with the Standard company, Mr. Hughes was connected with John A. Roebling Sons Company, at Trenton and Scranton, and with the Washburn & Moen Manufacturing Company, at Worcester, Mass., and Pittsburgh, Pa. He leaves a widow and two daughters.

DATES AHEAD.

Association of Edison Illuminating Companies. Annual convention, White Sulphur Springs, W. Va., September 14-17. Secretary, George C. Holberton, San Francisco, Cal.

Association of Iron and Steel Electrical Engineers. Annual convention, Cleveland, O., September 14-19. Secretary, W. T. Snyder, McKeesport, Pa.

Old-Time Telegraphers' and Historical Association and Society of the United States Military Telegraph Corps. Thirty-third annual reunion, Kansas City, Mo., September 15-17. Secretary of Old-Timers, F. J. Scherrer, 30 Church Street, New York. Secretary, Military Telegraph Corps, David Homer Bates, 658 Broadway, New York, N. Y.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 15-18. Secretary, C. R. George, Houston, Tex.

Vermont Electrical Association. Thirteenth annual convention, Brattleboro, Vt., September 17-18. Secretary, A. B. Marsden, Manchester, Vt.

Illuminating Engineering Society. Annual convention, Cleveland, O., September 21-24. Assistant secretary, Joseph Langan, 29 West Thirty-ninth Street, New York, N. Y.

Indiana Electric Light Association. Annual convention, Hotel Severin, Indianapolis, Ind., September 23-24. Secretary, Thomas Donohue, La Fayette, Ind.

Electrical Contractors' Association of Massachusetts. Annual convention, Worcester, Mass., September 23-24. Secretary, H. D. Temple, Worcester, Mass.

American Electrochemical Society. Twenty-sixth general meeting, Niagara Falls, Canada, October 1-3. Secretary, Joseph W. Richards, South Bethlehem, Pa.

New York Electrical Exposition and Motor Show of 1914. Grand Central Palace, New York, N. Y., October 7-17. General manager, George F. Parker, 124 West Forty-second Street, New York, N. Y.

American Electric Railway Association. Annual convention, Atlantic City, N. J., October 12-16. Secretary, Miss E. B. Burritt, 29 East Thirty-ninth Street, New York, N. Y.

Jovian Order. Annual congress, St. Louis, Mo., October 14-16. Mercury, Ell C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Electric Vehicle Association of America. Fifth annual convention, Philadelphia, Pa., October 19-21. Secretary, A. J. Marshall, 29 West Thirty-ninth Street, New York, N. Y.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual convention, Arkansas City, Kans., October 22-24. Secretary, W. H. Fellows, Leavenworth, Kans.

Telephone Pioneers of America. Annual reunion, Richmond, Va., October 29-30. Secretary, Henry W. Pope, New York, N. Y.

Seventh Annual Electrical Show, Coliseum, Chicago, Ill., October 31-November 14. Manager, Homer E. Niesz, 72 West Adams Street, Chicago, Ill.

With the Electrical Manufacturers

King Foundry Company, St. Joseph, Mo., reports that it has shipped more lamp standards up to the last of August this year than it shipped during the whole of 1913.

Joseph Dixon Crucible Company, Jersey City, N. J., has published a timely compilation of useful Spanish words and phrases. The company will be pleased to send copies of this book to those interested in information respecting the language of South and Central America.

The E. L. Russell Company, Indianapolis, Ind., has issued a booklet describing in detail with the aid of a large number of diagrams and curve sheets the design of the Silent-Valve construction for internal-combustion engines. The company has also issued a catalog of its Silent-Valve lighting and charging units. These are engine-driven generating sets for use in rural installations and can be used for farm lighting or for charging storage batteries, or both.

The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., has issued bulletin No. 228. This describes the company's new high-sensitivity galvanometer, which has recently been placed on the market. This instrument is the result of prolonged study of the details required to give a D'Arsonval galvanometer particularly high sensitivity. Four types of these galvanometers are made, two of them having low galvanometer resistance and two of them high resistance.

Detroit Insulated Wire Company, Detroit, Mich., is enlarging its manufacturing facilities by erecting a new saw-tooth building 57 by 138 feet in area, and of steel construction; a wood-working structure 35 by 50 feet is also being erected. The new buildings are required to provide space for more equipment. The general offices of the company will be located in a portion of the new buildings, the present quarters occupied for offices being required for factory use. Additional machinery and equipment has been provided and when installed will materially increase the company's producing capacity.

New Process Gear Corporation, Syracuse, N. Y., reports that it is working overtime to keep up with a volume of business larger than any heretofore handled. Although the plant was doubled in capacity less than two years ago and was at that time claimed to be the largest in the world devoted exclusively to gear making, an additional building is now being erected and the capacity of the case-hardening and heat-treating departments is again being doubled. Additional equipment already ordered for fall delivery includes: 10 Fellows gear shapers, 15 Gleason bevel gear generators, three Bullard vertical turret lathes, three Heald grinders, one Landis grinder, two National Acme automatics, and numerous special machines built to designs worked out by engineers of the company. The total production of the plant in spur, spiral and bevel metal gears and New Process noiseless gears and pinions will after January 1, 1915, be in excess of one million per year. A large part of this output is already contracted for by customers who have for years been large users of the New Process product.

Record of Electrical Patents.

Issued by the United States Patent Office, September 1, 1914.

1,108,886. System of Distribution. F. Conrad, Pittsburgh, Pa., assignor to Westinghouse Electric Mfg. Co. Combined integrating wattmeter and regulator.

1,108,892. Ignition Coil. E. Eisemann, Stuttgart, Germany. A special automobile ignition coil.

1,108,895. Signaling by Sound and Other Longitudinal Elastic Impulses. R. A. Fessenden, assignor to Submarine Signal Co., Waterville, Me. Low-frequency signals transmitted through water and transformed to high-frequency signals at detector.

1,108,905. Motor Controller. C. T. Henderson, assignor to The Cutler-Hammer Mfg. Co., Milwaukee, Wis. An automatic contactor starting panel.

1,108,907. Motor Controller. A. J. Horton, White Plains, N. Y., assignor to The Cutler-Hammer Mfg. Co., Milwaukee, Wis. A speed controller and starter.

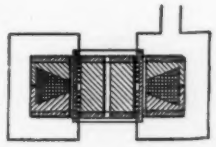
1,108,924. Electric Furnace. J. W. Moffat, Toronto, Ontario, Can. A crucible electric furnace.

1,108,927. Electric Signaling System. C. P. Nachod, Philadelphia, Pa. Vehicle-controlled railway-signal system.

1,108,931. System of Electrical Distribution. J. S. Peck, assignor to Westinghouse Electric & Mfg. Co. An equalizer system for polyphase alternating-current circuits.

1,108,934. Temperature Indicator. M. C. Rypinski, assignor to Westinghouse Electric & Mfg. Co. An electric indicating temperature device.

1,108,940. Collector Ring. C. W. Starker, assignor to Westinghouse Electric & Mfg. Co. Collector rings mounted on insulated tube.



1,108,895.—Submarine Signaling Coil.

1,108,998. Signaling System. M. Levison, assignor to Chicago Signal Co., Chicago, Ill. A hospital signaling system.

1,108,999. Annunciator Cabinet. M. Levison, assignor to Chicago Signal Co. An electric-light indicator.

1,109,004. Spark Plug. C. F. Meyer, Bridgeport, Conn. Covers details.

1,109,034. Sealing-wax Applying Device. B. Bryan, Washington, D. C. Has heating coils.

1,109,036. Electric Fuse. P. C. Burns, assignor to American Electric Telephone Co., Chicago, Ill. A refillable fuse, the fuse wire being placed in a heavy insulated tube.

1,109,058. Insulator. O. J. Fritz, Weisenburg, Pa. A pin insulator with vertical slot for holding wire firmly.

1,109,064. Ignition Apparatus. P. H. Hawker and I. J. Reuter, assignors to Remy Electric Co., Anderson, Ind. Has electromagnetically controlled resistance regulating means.

1,109,088. Driving Mechanism. D. H. Taylor and B. E. Connelly, Wheeling, W. Va. Bevel-gear motor drive for automobiles.

1,109,091. Time-Limit Control for Circuit-Breakers. C. S. Van Nuis, New Brunswick, N. J. A retarding device consisting of a liquid chamber, a float therein and a check valve in a restricted passage between chamber and reservoir.

1,109,104. Trolley-Wheel Mounting. J. Bisesi, Martinsville, Ind. Has means permitting oscillation of wheel.

1,109,111. Telephone System. O. Coleman, Wawanesa, Manitoba, Can. A combined telephone and telegraph system.

1,109,128 and 1,109,129. Galvanic Cell. M. L. Kaplan, Brooklyn, N. Y. Contains blue-colored neutral salts of a hydrated polymanganic acid.

1,109,150. Device for Lighting Gas Lamps From a Distance. L. Severin, Hagen-Delstern, Germany. Electromagnetic means for controlling and lighting gas street lamps.

1,109,163, 1,109,164 and 1,109,165. Telephone Exchange System. E. R. Corwin, assignor to Frank B. Cook Co., Chicago, Ill. A complete exchange system.

1,109,166 and 1,109,167. Telephony. M. L. Johnson assignor to Frank B. Cook Co. Automatic line switch.

1,109,181. Electrogalvanizing Solution. G. Sacerdote, assignor to The Metal Treating & Equipment Co., Inc., New York, N. Y. A solution of a salt of the metal to be deposited, together with a sulphate of iron and acetate of aluminum, said solution being substantially free of alkali salts.

1,109,216. Automatic Telephone Exchange System. G. Grabe, assignor to Siemens & Halske A. G., Berlin, Germany. Has means for preventing a second connection with party called.

1,109,234. Retrieving Trolley. C. E. Lang, Los Angeles, Cal. Has a fluid piston.

1,109,235. Control System. H. A. Laycock, assignor to General Electric Co. Includes means for operating generator on self excitation when exciter fails to regulate.

1,109,236. Regulating System. H. A. Laycock, assignor to General Electric Co. A modification of 1,109,235.

1,109,242. Signaling Device for Letter Boxes. C. E. McIntosh and S. S. Hopkins, Waynesboro, Va. Electric contact device for mail box.

1,109,244. Current Reversing Relay. E. J. Murphy, assignor to General Electric Co. Means for reversing flow of current in an auxiliary winding.

1,109,245. Electromagnetic Switch. E. J. Murphy, assignor to General Electric Co. Covers details of electromagnetic contactor.

1,109,280. Time-Controlled Operating Mechanism. G. R. Clark, assignor to Clark & Harvey, Dayton, O. An electric switch.

1,109,310. Telegraph Key. B. B. Youmans, College Park, Ga. Has separate dot and dash contact springs.

1,109,311. Method and Means for Electrolyzing Saline Solutions. E. A. Allen, Rumford Falls, Me. Has carbon anode and mercury cathode and intervening diaphragms.

1,109,325. Electric Drill. W. O. Duntley, assignor to Chicago Pneumatic Tool Co. Has incased electric motor.

1,109,338. Control of Electric Motors and Apparatus Therefor. P. N. Jones and J. W. Welsh, Pittsburgh, Pa. A series-parallel system of control for four motors which permits three motors to be actively in circuit at all times.

1,109,381. Signal System. F. H. Webster, Marvell, Ark. A relay semaphore signal system.

1,109,391. Collapsible Outlet Box. W. J. Billings and M. P. Caffe, New York. Has hinged sides.

1,109,397. Electric Despatch System. R. Brown, Greenville, Mo. A conveyor system with speed-governing means consisting of rocking trolley off of trolley wire.

1,109,411. Telegraph Transmitter. R. F. Gale, Fort Wayne, Ind. A double-action key.

1,109,415. Miner's Lamp. R. G. Harris, Bearden, Tenn., assignor of one-third to J. W. Hill and one-third to I. W. Hill. A battery miner's cap lamp.

1,109,450. Testing Lamp and Fuse Testing Device. C. W. Mitchell, assignor of one-half to C. W. Lansing, Brooklyn, N. Y. A lamp device for testing purposes.

1,109,470. Post Insulator. J. A. Sandford, Jr., assignor to The R. Thomas & Sons Co., East Liverpool, O. A built-up petticoated insulator.

1,109,472. Telephonic and Telegraphic Apparatus. J. Schiessler, Baden, near Vienna, Austria-Hungary. A relaying device.

1,109,511. Telephone Exchange System. E. E. Clement, assignor to F. C. Stevens, Attica, N. Y. An impulse-sending automatic system.

1,109,534. Controlling Device for Railway Vehicles. C. Konig, Vohwinkel, Germany. Means for indicating at fixed point the current used by train as means for estimating travel.

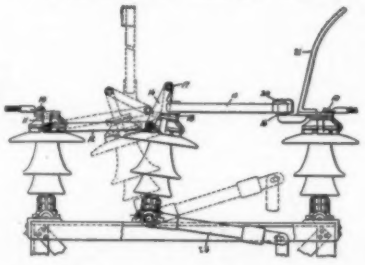
1,109,536. Apparatus for the Control of Electric Circuits. H. Leitner, London, England. A motor-driven battery regulator.

1,109,586. Line-Disconnecting Switch. E. M. Hewlett, assignor to General Electric Co. An outdoor switch with rocking insulator. (See cut.)

1,109,589. Electric Lamp Socket. M. Larsen, New York, N. Y., assignor of one-half to F. F. Hespe. Has a three-piece casing.

1,109,591. Welding Tool. S. S. Morgan, assignor to American Car and Foundry Co., St. Louis, Mo. Has a pair of special welding electrodes.

1,109,592. Electric Welding Apparatus. S. S. Morgan, assignor to American Car & Foundry Co., St. Louis, Mo. A special welding transformer.



1,109,586.—Outdoor Switch.

1,109,594 and 1,109,595. Electric Switch. J. A. Osborn, assignor to American Car & Foundry Co., St. Louis Mo. Has removable electrodes.

1,109,615. Telephone Exchange System. E. E. Clement, assignor to Frederick C. Stevens, Attica, N. Y. Semi-automatic system.

1,109,616. Electrical Signaling System for Telephone Exchanges. E. E. Clement, Washington, D. C. Selective ringing and connecting.

1,109,617 to 1,109,619. Telephone Exchange System. E. E. Clement, assignor to F. C. Stevens. Three patents covering automatic traffic-distributing switches between the subscribers' lines and operators, and automatic connectors controlled by the operators.

1,109,620. Telephone Exchange System. E. E. Clement. Includes an automatic rotary pilot switch.

1,109,621. Telephonic Apparatus. E. E. Clement. Relates to an automatic selector switch.

1,109,622. Telephonic Apparatus and System. E. E. Clement. Automatic impulse transmitter.

1,109,633. Electric Lamp Socket. C. G. Knauff, Chicago, Ill. Socket and reflector for extension lamp.

1,109,650. Telephone Exchange System. T. G. Martin, assignor to First Trust & Savings Bank, trustee, Chicago, Ill. Has automatic trunking means.

Reissue 13,795, Original No. 483,314, dated March 12, 1912. Signaling System. E. R. Gill, Yonkers, N. Y., assignor to Hall Switch & Signal Co. A telephone signaling and talking system.

Patents Expired.

The following United States electrical patents expired September 7, 1914.

589,412. Auxiliary Electric Contact. W. M. Brown, Johnstown, Pa.

589,429. Multiple-Series System of Electrical Distribution. C. D. Haskins, Brooklyn, N. Y.

589,430. System of Electrical Distribution. C. D. Haskins.

589,431. Telephonic Measured-Service System. H. V. Hayes, Cambridge, and T. C. Wales, Jr., Newton, Mass.

589,433. Starting Box for Electric Motors. R. B. Hirst, Brooklyn, N. Y.

589,445. Electric Hair-Singer. D. Seide, Hartford, Conn.

589,452. Traveling Contact for Electric Railways. W. F. Weiss, Stockton, N. J.

589,485. Electric Rail-Bond. G. H. Scott, Worcester, Mass.

589,509. Electrical Igniter for Gas Engines. E. R. Moffatt, San Francisco, Cal.

589,510. Watchman's Electric Time-Recorder. C. H. Phinney, Boston, Mass.

589,535. Electropneumatic Musical Instrument. R. W. Pain, New York, N. Y.

589,543. Electric Motor Car. H. P. Brown, New York, N. Y.

589,556. Transmission of Energy by Alternating Currents. C. S. Bradley, Avon, N. Y.

589,557. Lightning Arrester. C. S. Bradley.

589,566. Lightning Rod. E. Marshall, Garnett, Kans.

589,582. Electric Switch. J. B. Smith, A. W. Ferrin and A. L. Clough, Manchester, N. H.

589,617. Signal Box. A. C. Robbins, San Francisco, Cal.

589,618. Electric Switch and Cutout for Telephone Boxes. A. C. Robbins.

589,619. Telephone Transmitter for Signal Boxes. A. C. Robbins.

589,624. Underrunning Trolley for Electric Railways. S. H. Short, Cleveland, O.

589,669. Electric Safety Appliance for Railroads. E. L. Orcutt, Somerville, Mass.

589,672. Electric Meter. C. C. Schumacher and A. G. Zamel, Chicago, Ill.

589,674. Alternating-Current Generator. F. H. Sleeper, St. Johnsbury, Vt.

589,702. Trolley Wheel for Electric Cars. J. A. Crawford and T. E. Crow, Dallas, Tex.

589,726. Coin-Operated Telephone. F. Hoffman, Paragould, Ark.

589,746. Electric Signaling Apparatus and Circuit. E. H. Owen, C. N. Williams and F. H. Donaldson, Garvanza, Cal.

589,747. Annunciator System. E. H. Owen, C. N. Williams and F. H. Donaldson.

589,760. Electrical Junction Box. G. Tailleur, Chicago, Ill.

589,783. Dash Electric Headlight. J. Kirby, Jr., Dayton, O.

589,785. Surface-Contact Electric Railway. L. H. Parker, Schenectady, N. Y.

589,786 to 589,790. Closed-Conduit Electric Railway System. W. B. Potter, Schenectady, N. Y.

589,791. Surface-Contact Railway System. W. B. Potter.